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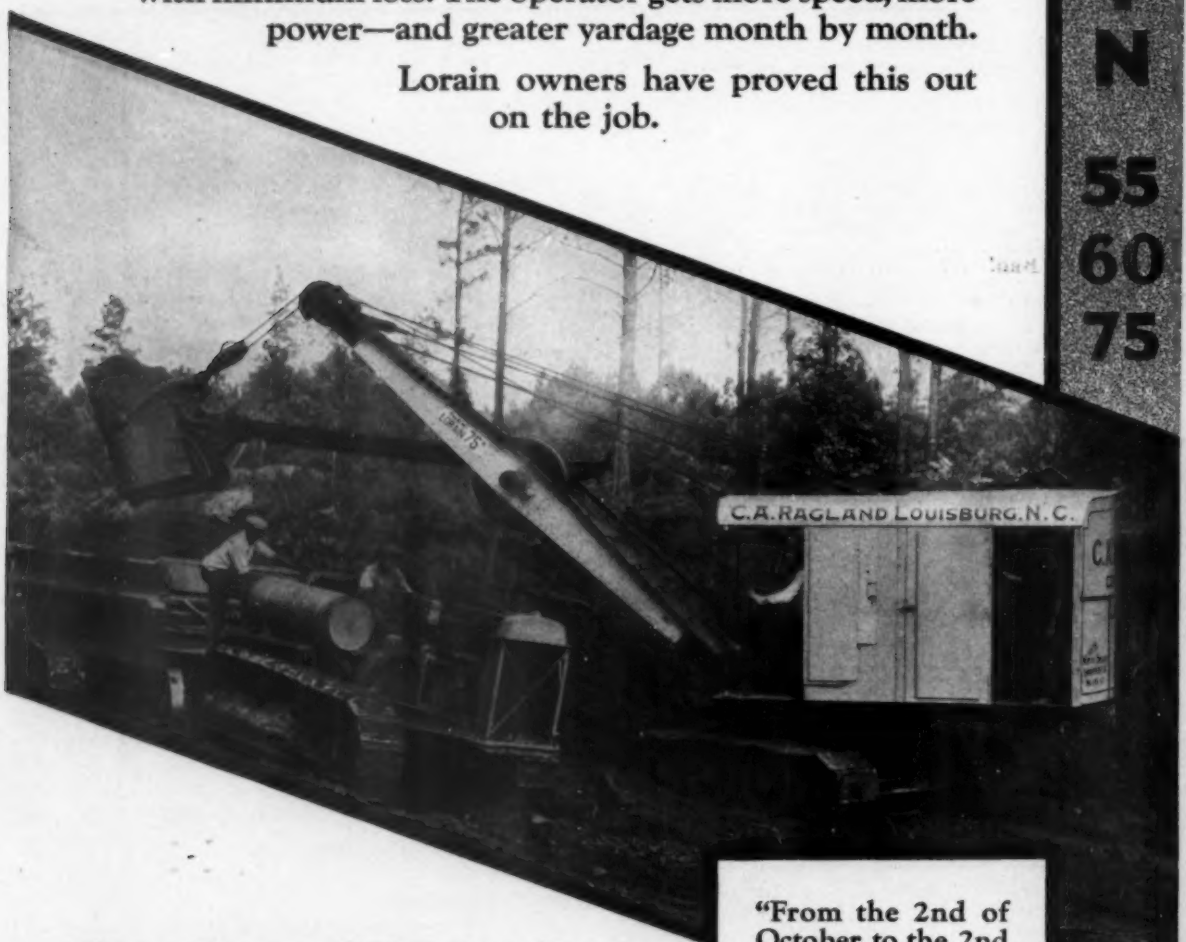

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No. IV

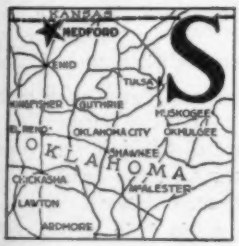
Contractors and Engineers Monthly

April,
1929

Competent Foremen on Every Section of Oklahoma Federal Aid Job

By J. A. Lindsey

Resident Engineer, Oklahoma State Highway Commission, Medford, Okla.



SECTIONS A and B, Unit 2, of Oklahoma Federal Aid Project 223, were built by Bert Brooks, of Oklahoma City, with E. W. Dahlgren as Superintendent in charge of construction. Mr. Dahlgren has very good organizing ability; he puts a competent foreman in charge of each unit of the work and then holds the foreman accountable for his particular part of the job. There was no overlapping of authority and the entire job functioned as a single unit.

This project consists of a standard 18-foot Bates road type concrete paving 9 inches thick at the edges and 6 inches thick for the center 14 feet. The work started at the north city limits of Medford, Okla., and runs 4.09 miles northeast, paralleling the C. R. I. & P. Railroad over U. S. Highway No. 81. The grading and structures were all completed in 1927. The road has a 30-foot traveled way with one 5- and one 4-degree curve. All of the grades are light with long, vertical curves. The contract for paving was awarded to Bert Brooks on September 6, 1928. The contractor shipped his equipment in at once, set up and started receiving materials. Actual paving operation was started September 15, 1928.

Fine Grading and Form Setting

Fine grading was done with fresnoes and teams, and a Russell 6-foot Junior grader drawn by a McCormick-Deering tractor. The contractor did not use a subgrader, as he was fortunate in having a very good grader foreman, who kept the grade well in advance of the paver at all times. On the grading in front of the mixer only two to four 2-horse teams and four laborers were needed. The grader foreman cut the form line to approximate grade and line with the Russell grader.

The form setter used two laborers who had no trouble in setting the 9-inch Blaw-Knox forms for the day's run in about 7 hours. Following the setting of the forms, the grade was bladed, and all low places filled with loose earth and the high places shaved off with the blade. The subgrade was then thoroughly compacted with a 5-ton Buffalo-Springfield roller. It was then checked by the subgrade inspector and grade foreman with a string and ruler between every form. The form line was checked and all of the forms securely tamped by two laborers using picks upset on the chisel end. These laborers also filled any depressions that appeared in the subgrade due to hauling the aggregate.

Aggregates

The coarse aggregate, a chert gravel, was furnished by the Yahola Sand & Gravel Co., Muskogee, Okla. The gravel ran very uniform and clean, so that no material was rejected. The sand was furnished by the Oklahoma Material Co., Enid, Okla., and fulfilled all of the state highway requirements. A field test was made of all material as it arrived, and check samples of every tenth car were sent to the state testing laboratory at Oklahoma City. The superintendent watched the ordering of the material very carefully, and at the end of the job there was practically no material left in the storage piles.

The aggregate was all unloaded from the cars with an Erie Type-B steam crane equipped with a ¾-yard clamshell bucket on a 30-foot boom. This crane handled all of the material to the batcher plant, as well as unloading all cars.

Atlas portland cement from Independence, Kans., was used. The cement was all tested at the mill and the cars were sealed with the Oklahoma Highway Department seal. The contractor did not use a cement house, but unloaded direct from the railroad cars to the batch trucks. He had a small cement dock, where he kept enough cement stored for loading the trucks while the trains were switching. No delays were experienced due to being short of material and not a cent was paid out for demurrage on either cement or aggregate.

Batcher Plant

The batcher plant was a Blaw-Knox bin and propor-

tioning unit, located about 1,400 feet from the south end of the work, making the average haul slightly over 2¼ miles. The plant was handled by a foreman with one laborer operating the bins, one laborer cleaning the cars, two laborers in the cement car, a crane operator, a fireman and a night watchman.

Batch hauling was sublet to individual truckmen, who were paid on a batch-mile basis. Thirty-eight trucks were used on the long haul, the number being reduced as the haul became shorter.

Reinforcing

The specifications required 5.76 pounds of reinforcing per lineal foot of road. Sheffield steel, furnished by the J. B. Klein Iron Co., of Oklahoma City, was used. The steel was all tested in the Oklahoma Highway Department laboratory. Six ½-inch square bars, 50 feet long, were placed longitudinally in the slab with 4-foot ½-inch round rods placed transversely every 5 feet. The 4-foot rods or dowels passed through the 5½-inch sheet metal V-shaped center strip. The 4-foot rods were tied to the longitudinal center bars with wire ties, and a shovelful of concrete placed under them to hold them in proper position. The outside bars were held in place by specially constructed hooks resting on the forms. These held the reinforcing in its correct position. These hooks were moved forward as soon as the concrete was deposited on the grade. One laborer placed the reinforcing, another tied it and moved the outside bars forward. One laborer placed the center strip and took care of placing the header boards.

Expansion Joints

Expansion joints were placed every 50 feet by setting a 1-inch header board, which was cut accurately to conform to the cross section of the pavement. A small trench was cut across the subgrade and the board securely pinned so that the top was about one inch below the finished surface of the concrete. After the concrete was placed and graded out, the pins were removed before the finishing machine passed over it. As the finishing machine was passing over the board the operator shook the board in several places with a tuning fork to make sure that the board was perpendicular with the surface of the slab. After the finishing machine operations were complete the board was raised to flush with the finished concrete and the concrete floated off smooth with the board. Just as soon as the concrete stiffened a bit, the board was raised about 2 inches and the slab edged with an edging tool, care being taken to push all coarse aggregate away from the board and work the mortar to the joint. As soon as the concrete would stand without slumping, the board was removed and the joint edged with an edging tool, care being taken inside with a long pointing trowel, to make sure that no honeycombs were left. The joint was then brushed with a whitewash brush and thus made ready for the burlap. One skilled laborer handled all of the joint work as well as assisting with the edging of the sides.

Later, the joints were poured with Texaco No. 39 asphalt, which was left about 1½ inches below the top of the joint to avoid bulging in hot weather.

The Mixer Crew

A Koehring 21-E mixer running a 6-sack batch was used. Two men cut and dumped the cement after the trucks turned and were backing to the skip. One laborer dumped the truck and another gave the driver a ticket for his load, keeping a carbon copy in his book, which was given to the timekeeper at the end of the day's run.

A heavy Lakewood subgrader was attached to the mixer rigidly, so that it could be drawn along with the mixer or backed up in case the first trip did not cut low enough. This finished the grade to the true cross section. Two laborers worked behind the subgrader to keep it cleaned out and make sure that no irregularities existed in the finished grade. Two other men were used to shovel the concrete and spade the sides. The concrete mix was 1:2:3½, but at no time were less than 1.625 barrels of cement used to the cubic yard of concrete. A very constant mix was maintained at all times with an average slump of one inch. Every batch was uniform, due to the uniformity of the water content in the material and the exactness and painstaking care of the mixer man.

Two depth tests of the poured slab were made every 50 feet by placing 8- x 8-inch tin shingles upon the subgrade and measuring the thickness of the green concrete with a long, slender screw driver. A record was made of all depths by the slab inspector and included in his daily reports.

Curing With Calcium Chloride

The first 10,000 feet of the job was cured with earth and water and kept wet for 14 days. Because of a shortage of water, the last part of the job was cured with a calcium chloride admixture on the basis of 1½ per cent by weight of portland cement used.

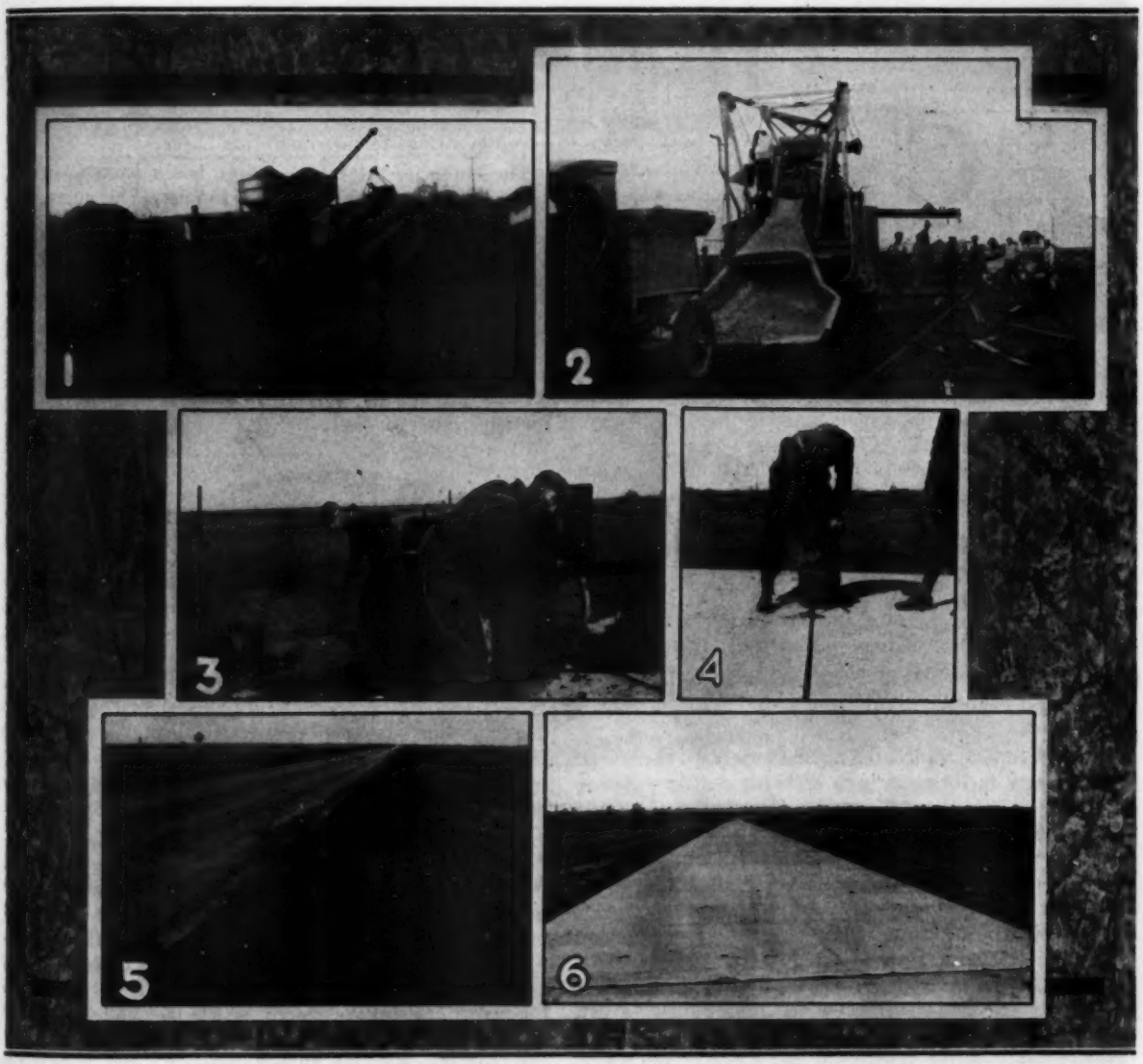
Dowflake calcium chloride packed in water-tight bags and about 88 per cent pure was used. The calcium chloride was mixed 150 pounds to 50 gallons of water in barrels along the outside of the forms. The mixing was done by the night watchman during the night, so that the solution would cool before using. The mixture was pumped up to a 50-gallon supply tank on top of the mixer. The supply tank was provided with an overflow pipe to a small 10-gallon tank about three feet from the ground on the mixer. When this tank became full the laborer operating the pump emptied it into the tank along the side of the forms. Just below the supply tank on the mixer there was a 5-gallon milk can provided with a water glass and an overflow pipe at the 3-gallon point. The small can was filled by gravity from the large supply tank by means of a hose and valve in the bottom of the supply tank. The 5-gallon can was provided with a hose and valve in the bottom connecting direct to the drum of the mixer. This can was also provided with an overflow pipe to the overflow tank. One laborer operated the chloride tanks from the ground with ropes connected to the valve. He allowed the solution to be discharged into the mixer at the same time the mixer was taking water.

Finishing the Slab

A new model Lakewood finishing machine was used on the slab. The best results were obtained by using the tamp and screed on the first time over and only using the screed the second time. One man operated the finishing machine, and he was followed by two hand finishers with long-handled 5-foot floats. After a double check with a 10-foot straight edge showed no variation the concrete was belted, and the wet burlap applied

as carefully and quickly as possible. Two laborers handled the burlap from a bridge which they rolled along the forms. It was found where the wet burlap was applied as quickly as possible that, while it marked the slab and sometimes stuck, there were no hair cracks. The burlap was kept wet for 24 hours.

It is interesting to note that the cement content on the entire job checked within 6 barrels of the theoretical amount required, and that the aggregate checked within a very few tons.



FROM STORAGE PILE TO FINISHED PAVEMENT AT MEDFORD, OKLA.

1. Blaw-Knox bins and batcher plant with stock piles and Erie steam crane in background. 2. The paving outfit stops a moment to pose—but for only a moment. 3. The heating kettle for the Texaco expansion joint filler. 4. Pouring a transverse expansion joint. 5. The finished pavement with the specially harrowed shoulder. 6. A long stretch of the road ready for traffic

SHOULDERS AND GUARD RAILS

The shoulders were constructed with teams and fresnoes and finished to a point 4 inches below the slab 6 feet out. Eight teams and three extra men did the shoulder work for the entire length of the job in 11 days. After the shoulders were roughed in they were bladed several times with a 6-foot Russell grader and thoroughly harrowed with a spike-toothed harrow. Two sections of the harrow were used in tandem, one behind the other, which proved very effective.

Wire cable guard rails were constructed by the Capitol Steel Co., of Oklahoma City. The guard rail was placed wherever the surface of the road is 5 feet or more above the borrow pits.

PERSONNEL

A very good daily average was maintained by the contractor, the 4.09 miles being poured in a little less than 26 working days, giving him an average of 833 feet of 18-foot pavement per 9-hour working day. E. W. Dahlgren was Superintendent in charge of construction for Bert Brooks, of Oklahoma City, the contractor, and C. H. Rightmire, Division Engineer, Oklahoma State Highway Department, was in charge of the work, with J. A. Lindsey as Resident Engineer.

A Complete Floating Concreting Plant

New Orleans River District, U. S. Engineer Corps Completes Construction of Huge Craft

CONCRETE mattresses are now being used for bank revetment along the Mississippi River supplementing and partially replacing the willow revetment which was exclusively used for many years. The New Orleans River District, Major W. H. Holcombe, Corps of Engineers, H. A. Thompson, Chief, Operations Division, with Lieutenant C. H. Corpening in charge of concrete mattress operation, and Walter C. Carey, Assistant Engineer, U. S. Engineers, as designer, has built a floating concrete plant for the rapid manufacture of these flexible concrete mattresses. It is expected with this new plant in full operation that 40,000 square feet of mattresses per 10-hour shift can be poured. The casting plant has been erected on a barge with a composite steel and wood frame and hull. All of the equipment, with the exception of the unloading crane and the aggregate bins, is completely housed in a steel frame sheathed with Robertson asbestos metal.

Cement Handling

The machinery is located in the center of the barge with storage facilities at both ends for cement. About 200 tons of cement, sufficient to operate the plant for one-half week on single shift can be stored on the barge. Cement is handled by four men loading five sacks on wooden pallets which run loose on a Matthews roller conveyor to the cement elevator. The elevator is controlled by a push button operated by the batcher man. When the elevator reaches the top, the pallet is discharged and the elevator immediately returns to the bottom of the chute to receive the next pallet. When the laborers empty the pallet, the pallet returns on a gravity chute, to the stackers at either end of the barge. All of the gravity conveyors used for loading the cement are on wheels so that they may be readily moved around the deck as the cement is used, thus eliminating all carrying of bags to the end of the conveyor.

From the loading of the cement on the pallet to the discharge of the mixed concrete into the forms on the mattress barges, all operations are independent, but are synchronized throughout a shift.

Aggregate Handling

Aggregate is secured from a river bar by an hydraulic dredge. The sand and gravel in this bar has an almost perfect proportion for concrete. Care has to be taken, however, that the nose of the dredge is always buried to prevent segregation of sand or gravel. The aggregate is loaded onto bin barges which are towed in strings to the concreting barge.

The crane on the mixing barge has a fixed position, picking and swinging at a fixed radius. The aggregate barges are moved when necessary by means of electric winches mounted at each end of the mixer barge. The control of these winches and cables is handled by a push button from the crane cabin. The crane operator is the entire aggregate crew, operating the Industrial crane, equipped with a 1¼-yard Blaw-Knox bucket, conveying the aggregate from the barges to the 40-yard Blaw-Knox bin as well as controlling the moving of the aggregate barges.

Batcher Equipment

The bin is equipped with two inundators in which cold or heated water may be used. The cooling water from the diesel engine is now used for mixing, but plans are being considered for heating at the engine muffler. With this plant 1,500-pound strength concrete will be produced. There is one man designated to operate each batch and one man to dump the one cement hopper. An independent operator trips the aggregate and cement, delivering it to the Smith 2-yard tilting mixer. The two men handling cement to the cement bins are required to empty five sacks per man every two minutes as each batch calls for approximately 10 sacks of cement for the designed mix which is permitted to cure about 10 days.

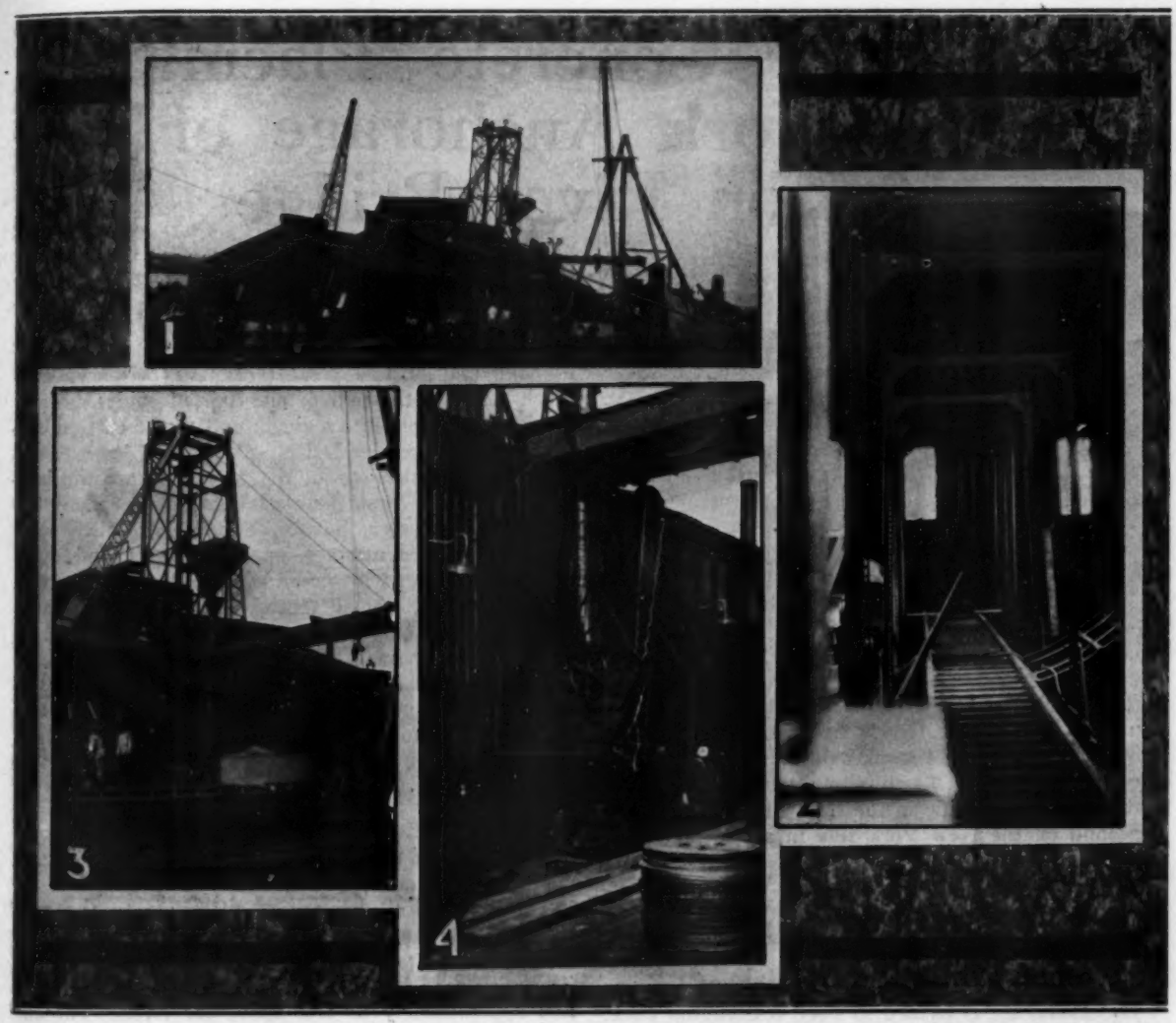
Concrete Handling

The mixer discharges into an Insley 2-yard roller hoist bucket which is elevated to a 3-yard receiving hopper from which a flexible chute empties the hopper into a one-yard Insley traveling bucket, the opening of which is manually controlled by the man riding the bucket. The bucket boom is 25 feet long and the bucket is arranged with a 3-foot gate which spreads the concrete over an area 25 feet long by 4 feet wide by 3 inches deep.

The mattresses are poured 15 layers to a barge in units of 100 square feet with 22 units to a layer. The richness of the mix is increased as the top layers are poured to speed up the set of the top layers. Two Flory towing winches on the outside corners of the barge operate cables attached to the end of the string of barges. The winches are controlled by push buttons by a man stationed near the distributing bucket who also controls the mixer and concrete hoist, the latter of which has limit switches.

Power Plant

A Busch-Sulzer 225-horsepower air-injection 4-cycle diesel engine, connected to a G.E. 440-volt, AC, 3-cycle



THE NEW FLOATING MIXING PLANT FOR CONCRETE MATTRESS WORK IN THE NEW ORLEANS RIVER DISTRICT

1. The complete plant, showing one of the cement storage sections at the left, the crane above and the bins and tower surmounted by floodlights amidships. 2. The roller conveyor for handling cement bags on wooden pallets. 3. The central section of the barge showing the tower and concrete distributor. 4. Detail of the concrete distributor.

generator, furnishes current for the operation of the entire plant. There is a G. E. main switchboard and voltage regulator installed. All motors have overload protection as well as low voltage protection and each motor has an I.T.E. circuit breaker and Sundh automatic starters. A 5-kw. Kohler lighting outfit is installed for use in furnishing electric light and power for the auxiliary pump when the main plant is shut down. The barge is equipped with floodlights outside for night operation.

The operating personnel of the casting plant for a single shift consists of about 12 white men (overseer, foreman, diesel engineman, and so forth), and about 90 laborers. A majority of the white operating personnel was employed on the design and erection.

Responsibility

IT is not necessary to accept the lowest bid, and it may be well worth while to pay a little more attention to a contractor who is dependable and who has a reputation of good construction work to live up to.—*Herbert Hoover.*

A Complete Concrete Plant Mounted on Crawlers

THE well-known principle that a concrete paving job can produce profits only while the mixer is laying slab was the reason for the development by the Schall Construction Co., of Michigan, of a new portable mixing plant. During the summer of 1928, this outfit paved 14 miles of 20-foot road.

The three units comprising the plant are the mixer, bins and crane, connected to form a train moved by one engine. Storage of materials to permit continuous mixing between deliveries is the essential feature of the outfit. The material capacity of the group is 40 yards of aggregate and 360 sacks of cement. All the units are mounted on Northwest crawlers and the crane is a Northwest with a 40-foot boom. Aggregates are stored in bins and a tractor moves the train and hoists the batch car. A specially built mixer with a 10-bag capacity completes the group. With the tractor motor running in low gear, the outfit moves forward at a rate of 120 feet per hour. The speed can be increased, if desired, by running the motor in second high gear, according to a recent report in *Job Jottings.*

Belts Speed Concrete Placing on New York Anchorage of Hudson River Bridge

By E. W. Bowden

Assistant Engineer, Port of New York Authority

BECAUSE of its unusual proportions the new Hudson River Bridge naturally arouses the interest of everyone, and especially of those who are engaged in the vast industry of modern construction. The bridge is of the suspension type with a clear span of 3,500 feet, double the span of any bridge completed up to the present time. The entire weight of the roadway structure is suspended from four 36-inch wire cables arranged in pairs. The cables in turn are supported by towers 635 feet high, greater in height and in section than the Washington Monument. Passing over these towers the cables, sloping downward, sustain the side span suspended structures and find anchorage,—on the New Jersey side in the solid rock of the Palisades, and on the New York side in an anchorage of concrete masonry.

It is the purpose of this article to discuss the concrete plant and methods used in constructing the first stage of the New York anchorage.

The Anchorage and Its Function

This anchorage is located in Fort Washington Park, just west of Riverside Drive. It is in general an irregular-shaped block of concrete 130 feet high, covering an area approximately 194 feet by 300 feet, and resting on bedrock. The anchorage may be thought of as composed of two great blocks of masonry, each block resisting the pull of one pair of cables. These blocks are merged into a single unit at the eastern end which faces Riverside Drive.

The Mixer Plant at the Beginning of Concreting Operations

The highest portions of the anchorage are the buttresses, which are at the western or river end of the anchorage. On these buttresses the cables will be supported in saddle castings, and passing beyond these points, the cables will spread out into their component groups of wire, termed strands. The loops of these strands engage castings from which the stress will be carried by a chain of steel eyebars embedded in the concrete mass down to the very lowest portion of the anchorage and near its rear extremity, where the last lengths of eyebar are attached to a grillage of anchorage girders.

Delivering Materials by Belts

The construction of the first stage, now nearing completion, involves the mixing and placing of over 105,000 cubic yards of concrete.

The economical delivery of materials to the concrete mixing plant, located just south of the center of the anchorage, presented a problem to the contractor. The anchorage is about 750 feet from the river front and approximately 85 feet above the river. The anchorage site is also cut off from easy access to the river by the cut of the New York Central Railroad. In addition the intervening ground surface is very irregular. A system of belt conveyors has provided a very expeditious solution of the problem. The system was designed by H. B. Gates, Engineer for the contractor, working in conjunction with the Engineer of the Conveying Weigher Co., and the Manhattan Rubber Mfg. Co., which installed the conveyor equipment and belts.

A dock was first constructed just behind the bulkhead line and the area behind it was filled and leveled off. Ample space was provided for the simultaneous unloading of barges of gravel, sand and cement. Unloading of the sand and gravel barges is done by means of two steam operated stiff leg derricks, using clam shell buckets. The sand and gravel are dumped in separate piles located over a tunnel running parallel with the dock. From these piles the aggregates are then carried by 1,000 feet of belt conveyor up to the mixing plant. A 26-inch belt, 250 feet in length, operating in the tunnel at a speed of 375 feet per minute, with a capacity of 300 tons per hour, receives either sand or gravel from segmental gates which can be so regulated as to discharge the desired quantity without overloading and consequent spilling of the materials.

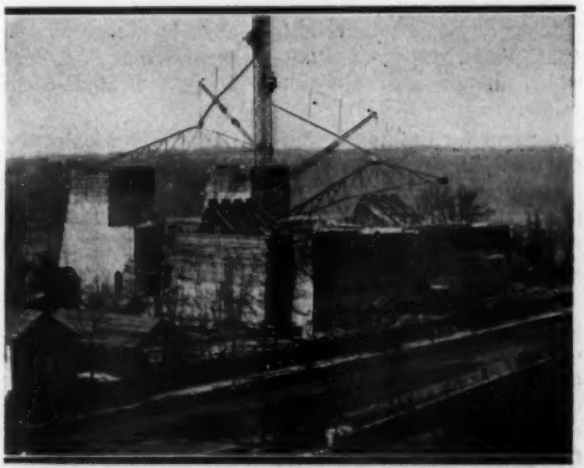
The Storage Pile and Conveyor Along the Hudson River, Showing the River and the New Jersey Tower in the Distance

This belt then discharges upon a second belt by which the aggregates are carried about 350 feet up the hill, where the aggregates are again discharged upon a third belt, 430 feet in length, which completes the trip to the concrete plant. It will be noted that the belt conveyor for carrying the sand and gravel directly up the hillside is divided into two units, each powered by an electric motor. This division is primarily on account of the load to be handled up the comparatively steep grades. When fully loaded from the river front to the mixing plant, the total load carried is about 10 tons. All the aggregate conveyor belts are 26 inches in width. The lower unit of the hillside pair, which negotiates a maximum grade of 32 per cent, travels at a rate of 390 feet per minute with a capacity of 300 tons per hour. The last belt of the series, upon which the lower belt discharges, is designed to travel at the rate of 410 feet per minute and handle the same quantity of materials. This last mentioned belt, by traveling at a slightly greater rate of speed carries the aggregates away when discharged upon it in such a manner as to avoid any piling up and spilling. The maximum grade of the second belt is about 12 per cent.

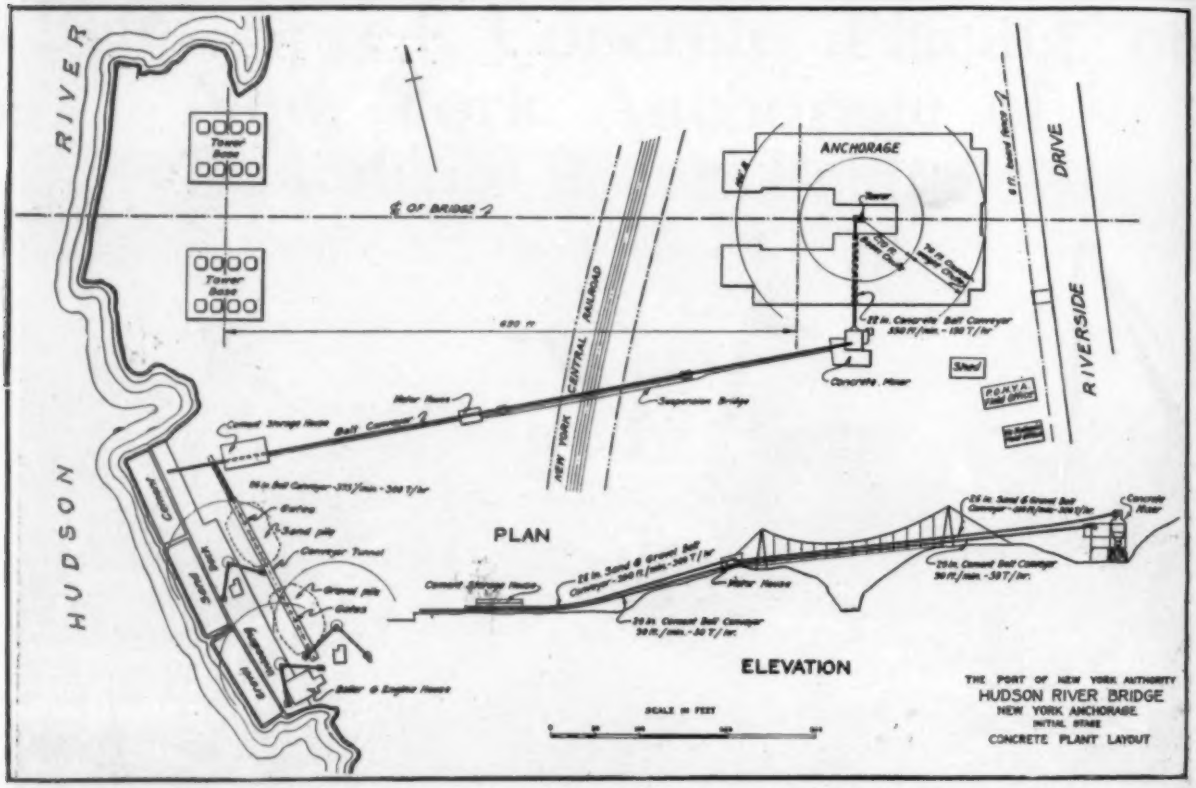
When operating over a grade such as those encountered, the question of the slipping of the aggregates on the belt becomes of some importance. No difficulty in this regard has been experienced. At the end of a run when discontinuing stone, the last of the material tends to slip, and it is felt that with grades steeper than the 32 per cent mentioned above, some difficulty might be experienced.

Cement is handled from barges to a cement belt which operates as a single unit directly from the water front to the mixing plant. About 3,000 bags of cement can be stored at the mixer. The remainder is removed from the belt as it passes through a cement storage house, located about 50 feet from the bulkhead. The cement conveyor belt is 20 inches in width, operated at a speed of 90 feet per minute and has a capacity of 50 tons per hour.

The belt for conveying sand and gravel operates directly above the cement conveyor belt. All belts are operated over troughing idlers, are equipped with screw take-ups, and are belt driven by 440-volt electric mo-



Construction of the New York Anchorage, Showing the Concreting Tower and Chutes



Concrete Plant Layout for the New York Anchorage of the Hudson River Bridge in Elevation and Plan

tors. To support the system, wood trestle work, in some places 60 feet high, was constructed. In bridging over the cut of the New York Central Railroad, a suspension bridge of 220-foot span, having supporting cables of 1¼-inch wire rope and 45-foot wooden towers, supports the conveyor system.

The Concrete Mixing Plant

The sand and gravel are received in 300-ton Blaw-Knox steel bins over the batchers. The cement is delivered by belt and stored in a cement room located at the same level as the Blaw-Knox bins.

The mixing plant is equipped with two Koehring 28-S, one-yard mixers, operated by electric motors. The aggregates are batched by weight by means of one 6,000-pound capacity Blaw-Knox weighing batcher, which dumps alternately into hoppers behind each mixer.

Cement for the mix is dumped into a 12-inch diameter feed pipe which leads from the floor of the cement room to the hoppers behind the mixers. The correct number of bags are dumped into the pipe from which the contents may be released by means of a flap valve at the bottom.

The mixing water is carefully regulated and is supplied through Koehring closed measuring tanks, equipped with air release valves and calibrated to half gallons. Each mixer is equipped with a timing device of the escapement type, which automatically locks the discharge chute until a given time has elapsed which, in the case of this mix, is 1½ minutes.

The contractor has been fortunate in working under unusually open winter weather conditions. However, for cold weather operations, steam pipes were placed over the tunnel at the stock pile, receiving steam from the plant which supplies the derricks. Steam pipes were also installed in the sand and gravel bins at the mixing plant, the steam used being generated by two boilers set up for the purpose. After placing the concrete in the forms a covering of tarpaulins and straw was used as a precaution against freezing.

Concrete Delivery

The mixed concrete is delivered to the forms with the greatest economy of motion by means of belt, hoisting tower and chute.

A 260-foot Insley tower is erected near the center of the anchorage on the center line of the bridge. The mixing plant is located opposite the center of the anchorage and about 120 feet south of the center line of the bridge. The two mixers discharge into a hopper of 3 cubic yards capacity, which feeds onto a 22-inch belt approximately 120 feet long, which operates at a speed of 550 to 600 feet per minute and has a capacity of 80 cubic yards per hour.

The belt, in traveling between the mixer and Insley tower, passes through a 6- x 6-foot tunnel left in the south half of the anchorage for this purpose. This concrete delivery belt discharges into a 2-yard hopper at the foot of the tower, from which position it is hoisted in a 36-cubic foot capacity reversible bucket. The tower is equipped with two 75-foot boom chute, placed on opposite sides of the tower on sliding frames anw two 75-foot counterweight chutes, providing for

the coverage of an area within a 140-foot radius in all directions.

The tower hoist is manufactured by the Clyde Machinery Co., and is operated by a 100-horsepower electric motor, hoisting the bucket at the rate of about 380 feet per minute.

A careful study of the plant as a whole, comparing the plant items to determine relative capacities, discloses the fact that the cement belt, the aggregate belts or the concrete delivery belt are never taxed to capacity. In fact, they are never taxed above 80 per cent of capacity. When placing concrete at elevations up to 50 feet above the mixer elevation (at Elevation +125.00) the mixer governs the amount of the output. At higher elevations the operations of the hoist govern and limit the output.

The following table gives the results of an actual comparative study made by the engineers in the field:

ELEVATIONS AT WHICH CONCRETE IS PLACED

	El. +100 (25 ft. Above Mixer)	El. +150 (75 ft. Above)	El. +200 (125 ft. Above)
Cement Belt	80% of max. cap.	73%	60%
Aggregate Belt	77% of max. cap.	70%	58%
Mixers	100% of max. cap.	91%	75%
Concrete Belt	72% of max. cap.	66%	54%
Hoist	89% of max. cap.	100%	100%

The plant as a whole has proved remarkably efficient, supplying concrete as rapidly as it could be handled in the forms. On several occasions, a total of 1,000 cubic yards has been mixed and placed in the course of a 16-hour day, two shifts operating.

Segregation of Concrete

In a large scale operation of this character, employing belt conveyors and chutes, the questions of uniformity of concrete and segregation naturally arise.

The method of loading the gravel from the storage pile to the belt by means of segmental gates was found to have a tendency toward separation of the coarse gravel and the finer particles, since the larger gravel would tend to roll down ahead of the finer material. However, a uniformity of mix was secured by introducing a baffle board at the storage bin of the mixing plant. The gravel on leaving the delivery belt was discharged in the bin by first striking the baffle board.

A small amount of segregation of the mixed concrete on the delivery belt was experienced, and eliminated by synchronizing the mixers and by operating the belt at a speed which gives a uniform delivery of concrete into the receiving hopper at the base of the Insley tower. Two laborers are employed at the hopper to clear concrete into the hoist bucket and to guard against loss of mortar clinging to the belt conveyor. Some segregation occurs in the hoist bucket and in the process of chuting. A great portion of this is overcome, however, by introducing a baffle at the end of the chute, and by attaching an "elephant trunk" which deposits the concrete with a vertical drop. The concrete is then thoroughly spaded in the forms.

Control of Concrete

All concrete is designed according to the cement-water ratio method for a 28-day compressive strength of 2,480 pounds using 7 gallons of water and 5 bags of cement per cubic yard of concrete and resulting in a slump of about 4 inches. A field laboratory is located

The New York Anchorage, Showing the Concrete Plant at the Left and Embedded Steel Work in the Center

View of the Conveyor System and the Mixer Plant From the Anchorage

at the base of the mixing plant. Equipment is provided for the examination of aggregates for moisture content in order that changes in the amount of mixing water may be made quickly. Provision is also made for frequent slump tests and for making test cylinders.

An average of 2,410 pounds per square inch was obtained in testing 257 standard 8 x 16-inch cylinders, broken at 28 days, and with none eliminated. Eighty-eight per cent of the specimens were within 20 per cent of the average strength.

COMPLETION OF CONTRACT

Although the date for completion was set at June 11, 1929, work has progressed so rapidly that this portion of the anchorage is now practically completed, representing an advance of about three months on the allowed contract time.

PERSONNEL

The contractor on this operation is the Arthur McMullen Co., of which E. P. Palmer is Secretary, and H. B. Gates, the engineer. The work is being done for the Port of New York Authority, of which body O. H. Ammann is Chief Engineer of Bridges. M. B. Case is the Engineer of Construction of the Hudson River Bridge, and Robert Hoppen, Jr., Resident Engineer in charge of the New York operations.

Leaving Blasting Caps Unprotected Followed by Serious Consequences

THE serious legal consequences which may ensue as a result of leaving blasting caps carelessly about where children can get them and play with them are shown in a number of law suits which have recently been filed in various parts of the country. In one of these, a boy lost his right eye and suffered injuries to his kneecap which, it is claimed, crippled him permanently. As a result, his father is now suing for $50,000. It is claimed in this case that workmen of the defendant company, which was engaged in building a fence near the boy's home, carelessly left a number of blasting caps around. They had been using the caps to detonate dynamite in blasting post holes.

In the state of Washington, a suit was entered for $6,500 on behalf of a twelve-year-old boy who played with blasting caps and, as a result, had his thumb and two fingers blown off. It was claimed that a crew of workmen employed by a contractor carelessly left these caps where the boy could find them.

In Kentucky, legal representatives of an eight-year-old-boy were awarded $6,500 for the loss to the boy of an eye and for other injuries caused by the explosion of a dynamite cap. The defendant in this case was a company which had done contracting work on a school which the boy attended. It was claimed that some of the workmen employed by the company left caps unprotected and they were found by the boy in the basement of the school. The jury took the view that the contracting company was responsible.

Another suit for $25,000 has been filed before an Illinois court as compensation for the injuries caused to a ten-year-old boy who lost three fingers as the result of an explosion of a dynamite cap. The suit is filed against a company which was doing some work near the boy's home. It is claimed that the defendant took no precautions to prevent the boy from picking up and playing with the blasting caps.

These cases clearly show that damages are quite likely to be demanded when the injured parties feel that blasting caps have been carelessly left about where children can play with them and accidents result.

Not only from the dollars and cents point of view, but far more from the humane point of view it is of the greatest importance that contractors, miners and all others using blasting caps be extremely careful to see that these are properly put away when work is done. The cases cited above show that employers are responsible for the acts of their workmen.

Statistics gathered in a nationwide survey by the Institute of Makers of Explosives show that approximately 500 children each year are maimed or injured by playing with blasting caps. In some cases children are killed. The Institute of Makers of Explosives, recognizing the danger of children playing with blasting caps, has enlisted the support of a great number of institutions throughout the country in warning parents, employers and the children themselves of the danger of playing with these articles. The National Safety Council, the Bureau of Mines, the Department of Agriculture, the Surgeon General of the Public Health Service of the Treasury Department, various mining institutions and the school authorities of almost every state in the Union have cooperated in this movement. It is of the greatest importance that contractors, miners and all others whose workmen use blasting caps should also cooperate to the end that these accidents may be done away with.

Practical Railway Painting and Lacquering

WHILE this book is primarily intended for railroad men, it has a great deal of interest for contractors, municipal authorities, state highway officials and others, as it presents not only a great deal of general information on the painting and lacquering of locomotives, freight and passenger cars, but also data on the painting of bridges, buildings and water services. The authors are H. Hengeveld, Master Painter, Atlantic Coast Line Railway, C. P. Disney, Bridge Engineer, Canadian National Railways and William J. Miskella, Director, Finishing Research Laboratories, Inc. The book contains a vast amount of valuable material, is illustrated and contains 242 pages of text. It is published by the Finishing Research Laboratories, Inc., of Chicago, as Volume IV of its Practical Finishing Series. It is being distributed by the Simmons-Boardman Publishing Co., New York City. Price $3.50.

Introducing Pre-Mixed Concrete In Cincinnati

By Arthur C. Avril

President, Avril Tru-Batch Concrete, Inc., Cincinnati, Ohio

WITH the advent of Abram's water-cement ratio theory for the design of strength concrete, the central mixing plant on a commercial basis has come into existence. It is true that concrete had been poured from central plants and transported by truck or rail quite a few years ago, but the practice was not universal because of inadequate transportating equipment and a limited knowledge of the proper proportioning of concrete. It was not until about four years ago that strictly commercial plants began operating.

The industry is still in its pioneer days, but is having a rapid growth. It is being recognized as a necessary addition to the industries of any fair sized community. All the large equipment companies are adding central mixing plant equipment to their line of products and more than a dozen different types of concrete transporting vehicles are now on the market.

The numerous advantages in the use of pre-mixed concrete are responsible for the rapid growth of the industry. It is undoubtedly the only economical way to serve all classes of concrete construction with concrete, proportioned and mixed uniformly under scientific control. This feature is especially desirable in that specifications are becoming more rigid. The other attractive features in its use which enable the contractor to lower his cost in many ways are:

1. It eliminates the necessity of the tying up of capital in expensive proportioning and mixing equipment.
2. It eliminates the cost of installing, maintaining, operating and removing the job concrete plant.
3. It eliminates about 50 per cent of the labor necessary to mix and place concrete.
4. It eliminates the cost of transporting mixing equipment to and from the job.
5. Water-line construction is eliminated.
6. There is no wastage of aggregates.
7. It very materially simplifies concrete construction in congested districts.

In addition to these there are any number of minor reasons why pre-mixed concrete is more satisfactory and economical than that mixed on a construction job.

Important Factors Governing Plant Installation

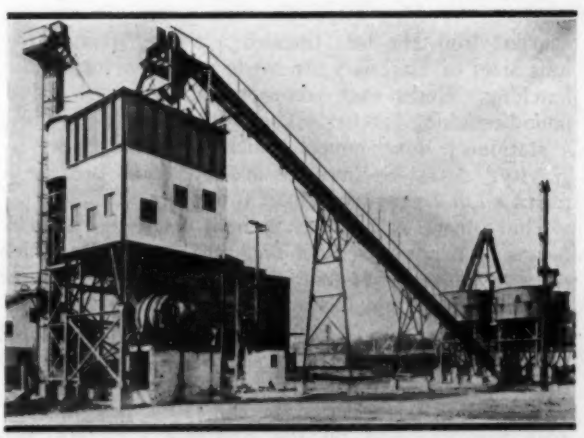
Many problems arise in establishing and building a central mixing plant. The first and most important is plant location. It should be located in the geographic center of the future building development of any city. Adequate rail facilities and ready access to the source of supplies are essential.

Next in importance is the choice of transporting equipment. To haul concrete of any consistency satisfactorily and economically for long distances, an agitator truck of a high speed type mounted on pneumatic tires is essential in that it practically eliminates sales resistance.

To operate a central mixing plant economically the design and plant lay-out are of vital importance. It should be so arranged as to handle materials rapidly at low cost. To do this the equipment must be well designed so that all units are of the proper type, size and capacity to make a well coordinated operation for the production of concrete on a profitable commercial basis.

There is also the problem of promoting the use of pre-mixed concrete. With a well designed plant and the proper transporting equipment this is not difficult if some effort is spent in conducting an educational program by mail and personal calls while the plant is being erected and in the early stages of production. Whenever the contractor requires concrete the plant must be prepared to serve him and must arrange deliveries so there will be a steady flow of materials to keep his men busy until the job is completed. This requires a dependable, capable and honest organization of men, well versed in their particular phases of the operation. A good superintendent to take care of equipment and material handling, and a traffic manager to schedule and route the trucks should be well acquainted with their work.

As everyone knows it is vitally important for a contractor to be supplied with concrete at regular



THE AVRIL TRU-BATCH READY-MIXED CONCRETE PLANT IN CINCINNATI

From left to right, the vertical Columbus bucket conveyor for cement, the bins and enclosed batchers and mixer, the Columbus belt conveyor, leading from the aggregate storage bin

Pouring Ready-Mixed Concrete Directly into the Forms from a Tru-Batch Agitator Truck

intervals, the length of interval depending upon the type of job and the speed with which he can handle it, in order that he be satisfied with the use of pre-mixed concrete. Regular deliveries and a uniform product are a plant's best salesmen.

DESCRIPTION OF CINCINNATI PLANT

In planning the central mixing plant in Cincinnati it was necessary to stress the importance of accurate, scientific control and install equipment which would produce economically a product as true as possible to a laboratory control mix. A plant was designed which could be operated at a production of 400 cubic yards per 8-hour day with one superintendent and four laborers.

As the accompanying illustrations show the plant consists of a bucket elevator 65 feet high fed by a reciprocating plate feeder located under the track. The elevator can be discharged through a swivel spout into any one of four standard Blaw-Knox 18-foot diameter circular self-cleaning bins each having a capacity of 300 tons. One size of sand and three sizes of gravel are stored in them for reserve supply. Material is fed from the circular bins by gravity onto an 18-inch belt conveyor, 185 feet long, inclined at an angle of 22 degrees, which carries it to the top of a 200-ton 4-compartment batching bin. The four compartments are charged from the belt through a swivel spout. The four sizes of materials are made available for instant batching. Under each compartment there is a 2,500-pound weighing batcher. These discharge directly into a stationery mixer-hopper which feeds the mixer by gravity. A 56-S Ransome mixer is used because it mixes a full 2-yard truck load at one time.

The cement is handled in bulk from the cars by means of a power scraper and bucket elevator which elevates it to a 15-foot diameter, totally enclosed circular cement bin having a capacity of 587 barrels. It discharges into a 2,000-pound cement weighing batcher. From the batcher the cement is carried to the mixer-hopper by a screw conveyor.

The water is measured in the latest design water tank manufactured by the Ransome Concrete Machinery Co. It is calibrated in both pounds and gallons, and is so designed and constructed that the water content of consecutive batches of concrete can be varied with no delay. This is very vital in the efficient operation of a central mixing plant because it is not uncommon to have four or five entirely different mixes for the same number of consecutive batches.

It was thought advisable to use the four circular self-cleaning bins for storing aggregates because they minimize segregation. Material handling cost is low because it is necessary to use only common labor to operate the bucket elevators and conveyors.

In order to give concrete a uniform strength and consistency the batching equipment is so arranged that the grading of the aggregates is always uniform, the cement content for any specific mix is constant and the water is under rigid control. The sand and gravel batches are used to weigh sand and the three sizes of gravel so that part of each can be included in the mix. This method of batching maintains a constant fineness modulus, thus insuring a uniform gradation at all times.

BULK CEMENT

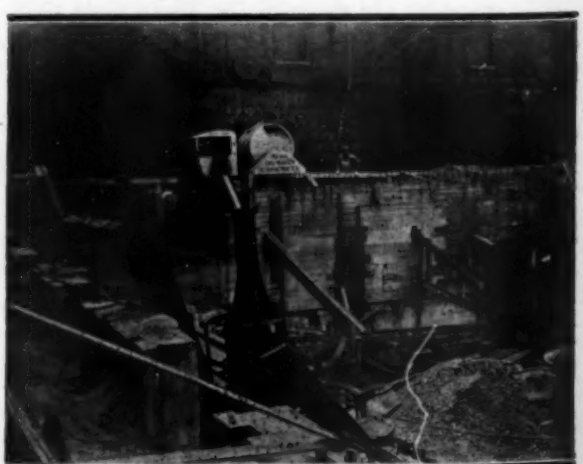
The reasons for using bulk cement are that it is more economical than using sack cement and it permits the application of a strictly scientific proportioning.

The savings in the use of bulk cement over sack cement are:

1. The price of bulk cement is less than sack cement.
2. Less labor is required to unload cars.
3. No labor is necessary for cleaning, handling, baling and returning empty cement sacks.
4. There is no loss of damaged sacks.
5. No records must be kept on sacks.
6. It is not necessary to provide storage for empty sacks.
7. There is but one handling cost, as compared to two when sack cement is used.

It is estimated that not less than forty dollars per 250 barrel car is saved.

It is not economical when using sack cement to split sacks. For this reason invariably more cement is used than is required to give a definite uniform strength for which the concrete is designed. Bulk cement can be weighed to within one or two pounds of the pre-determined quantity estimated. The result is a more economical concrete, especially since the gradation of aggregates is under rigid control.



Pouring a Part of the Foundation for the St. Louis Cathedral in Cincinnati with Tru-Batch Ready-Mixed Concrete

Date _____ 192____

Avril Tru-Batch Concrete, Inc.
DAILY JOB SHEET

Ticket No.	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back

Record Sheet Which Shows the Location of Delivery Trucks at All Times

PROVISIONS FOR WINTER CONCRETE

In order to produce a high quality concrete in the winter time the plant is equipped with a 25-horsepower vertical high pressure boiler and a 700-gallon hot water storage tank. The bins are all lined with coils which keep the aggregates warm when steam is passed through them. The water is heated in the 700-gallon tank by injecting live steam into the water. This tank is not of the open type but is totally enclosed which permits heating the water at a pressure equivalent to the boiler pressure. When the pressure in the tank and boiler are equal no steam enters the water tank. This feature eliminates the necessity of a continuous flow of live steam into the water to keep it at the proper temperature as in the case of an open tank. No pump is necessary to feed the hot water to the metering tank because the pressure tank permits the use of water under city pressure through the entire system.

It has been found by test that this heating plant makes it possible to discharge concrete from the mixer in weather below freezing, at a temperature of approximately 70 degrees.

Even during the most severe weather there is but very little heat lost in transporting concrete for distances of 6 or 7 miles. By taking these precautions it has been found that it sets almost as rapidly in the winter time as in summer and eliminates the use of chemicals to lower its freezing point.

TRANSPORTING EQUIPMENT

The most important problem confronted by the Cincinnati plant was obtaining suitable conveyances which would deliver concrete in good condition economically. Open trucks of the non-agitator type were tried and found satisfactory for hauling very dry mixes. Concrete having a consistency of more than a 2-inch slump could not be transported in this type of equipment farther than one-half mile from the plant without causing a serious loss of time in unloading because of the segregation of aggregates and compacting which make the concrete stick to the trucks.

The different types of agitator and mixer trucks were investigated with the view of using them exclusively. It was found however that all were sold at a very high price and were mounted on heavy slow-speed truck chassis. None of them appeared to be an economical means for concrete transportation. The type of truck desired was one having a body which agitated the concrete, mounted on a relatively light dual pneumatic-tired high-speed chassis which would not cost much more than a regular dump truck. The Cincinnati company designed a truck of this type the cost of which compares very favorably with that of a dump truck mounted on the same type and make of chassis.

The specifications for it are as follows:

Capacity	2 cubic yards
Weight complete	9,100 pounds
Height overall	98½ inches loaded, 102 inches empty
Total width of body	83½ inches
Width of tank	64½ inches
Diameter of tank	60 inches
Width of gate	20 inches
Length of gate	24 inches
Average loading time	same as mixer discharge time
Average unloading time (continuous)	2½ minutes
Mounted on	Schacht 2½ ton chassis
Speed	30 miles per hour
Wheel base	126 inches
Tires	34 x 7 pneumatics, duals rear
Engine	Waukesha six cylinder
Frame	7 inch pressed steel
Wheels	Budd Disc

As the accompanying illustration shows, the agitator body consists of a cylindrical drum with tapered ends mounted transversally on the chassis. The power which revolves the drum is transmitted from the truck motor through a special ball bearing mounted power take-off, a fifty to one worm reducing unit and a chain drive. The motor speed of 1,800 r.p.m. at 25 miles per hour gives the drum a speed of 5 revolutions per minute through the worm and chain reductions.

The truck has some very desirable features which tend to deliver concrete economically in good condition.

OFFICE COPY

AVRIL TRU-BATCH CONCRETE, Inc.

MANUFACTURERS OF PRE-MIXED CONCRETE
ESTE AVE. & B. & O. RAILROAD
WINTON PLACE
CINCINNATI, O.

Date _____

Contractor _____

Deliver to _____

Truck No. _____ Zone _____

Yards _____ Strength _____

Mix _____ Slump _____

Class of Work _____ Aggregate _____

Leave Plant _____ Arrive Job _____

Leave Job _____ Arrive Plant _____

Inspected by _____

Signed _____

No. 2269

This Ticket in Triplicate, for Office, Customer and Auditor, Gives the Complete Record of Each Truck Delivery

ORDER

Avril Tru-Batch Concrete, Inc.

Este Ave. and B. & O. Railroad
(Winton Place)

Cincinnati, Ohio Phone Kirby 4594

Order No.....
Date....., 19.....
Terms .....

Charge to .....

.....

Deliver to .....

.....

....Cubic Yards Concrete

Mix .....

Slump .....

Lbs. Comp.....

Price Quoted $.....per Cubic Yard

Delivery Schedule..... Cubic Yards per Hour beginning.....

Signed.....

Accepted By.....

Order Blank Which Gives All Necessary Information for Mix, Delivery and Billing

The tank being mounted transversally with the chassis frame keeps the load while in agitation perfectly balanced on the truck chassis. It operates at a speed which is the same as passenger car traffic. The short wheel base allows the driver to drive in traffic with very little delay and speeds up the hauling time because the truck is not delayed in turning around. The LeBlond-Schacht Truck Co., is equipping its chassis with the above described body.

An example of the quantity of concrete this type of truck can pour; on one job in Cincinnati three trucks delivered 142 cubic yards of concrete in five and one-half hours, the round trip haul being 3 miles.

HANDLING PRE-MIXED CONCRETE ON THE JOB

The only economical way in which to handle concrete on the small job up to 25 cubic yards is to dump into a box large enough to handle a full load, or to dump it on the ground. The additional handling cost is not enough to make the use of pre-mixed concrete unattractive because usually, for this class of work, the dry materials are much higher priced than for the larger jobs. Mechanical handling in this case would be much more expensive than handling by hand.

For the large building job, where concrete must be elevated and spouted, it is the usual practice to install a large hopper at the base of the tower, arranged so the trucks can dump directly into it. By using this method, the contractor always has a reserve supply to fill his skip at regular intervals. This is a profitable practice, because regardless of how careful the delivery schedule is regulated at the plant, variable traffic conditions greatly influence the deliveries. On one particular job here, it was a very simple matter to make a round trip in forty minutes under normal traffic conditions. After 4 P. M. and at noon, it was a regular daily occurence for the round trip time to increase to fifty minutes. This meant the addition of one more truck on the job to keep the contractor satisfied. Even then there were times when the proper interval was not adhered to but the hopper usually held a large enough reserve so the delay was not noticed.

It is naturally assumed that a street paving job offers the least number of problems in placing concrete mixed at a central plant. Under ideal weather conditions and on a well compacted base this is true. On a new base made of filled ground or in wet weather it is difficult to keep the grade in good condition especially if the concrete is hauled in open dump trucks, because they must always be backed to the concrete already in place thereby making ruts which cannot economically be leveled off. Paving under these conditions makes it imperative to be able to spout from 6 to 8 feet to the rear of the truck. This cannot be done with the regular open type truck, but with the agitator type used at this plant, it is a very simple matter. By doing this there is always a 6- or 8-foot stretch of sub-grade which can always be maintained in good condition.

As was stated in the first part of the article the proper scheduling of trucks is vital to the successful operation of ready-mixed concrete. An accurate record of deliveries must be kept on all jobs so that the contractor receives a steady supply of concrete. These records are kept on a chart as illustrated. In this way the traffic man knows at all times where the trucks are and has a fairly close check on them. It also enables him to instruct the plant in advance as to what mix must be loaded and the approximate time. This tends to accelerate the operation.

The Cincinnati plant has been in operation about 6 months, during which time it has delivered concrete to all the public utilities, the city highway department and a good percentage of the leading local building and paving contractors. It has also furnished concrete to some of the leading industrial plants for use in large machine foundations and repair work. The outlook for the coming season is very attractive with good possibilities of operating the plant at nearly maximum capacity during the summer months.

A Practical Treatise on Suspension Bridges

OVER half a dozen suspension bridges have passed the century mark, over a score have remained in use over 75 years, and some three score have carried their traffic more than 50 years. The first outstanding suspension bridge, having a span of 70 feet, was built in 1741 over the River Tees in England. The first in the United States had a span of 72 feet and was built in 1796 in Uniontown, Pa. In his recently published book on suspension bridges, Dr. D. B. Steinman, Consulting Engineer, M. Am. Soc. C. E., fully covers the design, construction and erection of these very important structures. From the mathematical considerations involved in their design, through the practical features of construction and erection, the book is replete with valuable information. The chapters include discussions of stresses, various types of suspension bridges, followed by details of construction, typical design computations, erection of suspension bridges, design charts for this type of bridges and two chapters devoted to the Florianapolis Bridge and the Ohio River Suspension Bridge at Portsmouth and ending with an interesting chronological table of suspension bridges. This volume is published by John Wiley & Sons, Inc., New York, price $5.

Westfield, Mass. Builds Large Earth-Fill Dam

By E. B. Myott

Resident Engineer, Fay, Spofford & Thorndike, Boston, Mass.

THE construction of the Granville Dam for the City of Westfield, Mass., now under way, involves a total expenditure, exclusive of the purchase of land, of $630,000. The work comprises the building of an earth dam and appurtenant structures, the preparation of the reservoir site for the storage of water, and the building of a short supply main. Most of the work is being done under contract. Bids for the work were received September 12, 1927, and the contract was awarded to the low bidder October 28. Fifteen contractors submitted bids, ranging from $430,000 to $880,000; the lowest bid was 26 per cent below the average of all bids.

Construction work began in the late fall of 1927 and continued to February, 1928. Only a very small amount of work was done during this period; namely, the construction of a contractors' camp, the laying of about 600 linear feet of 20-inch pipe, and the erection of a cableway. Work began in earnest in April, 1928, and was carried on as fast as practicable until the first of December, 1928 ,when all operations were stopped on account of the weather. During this period, work costing $350,000 was completed. The indications are that the project will be completed well within the specified time of October 31, 1929.

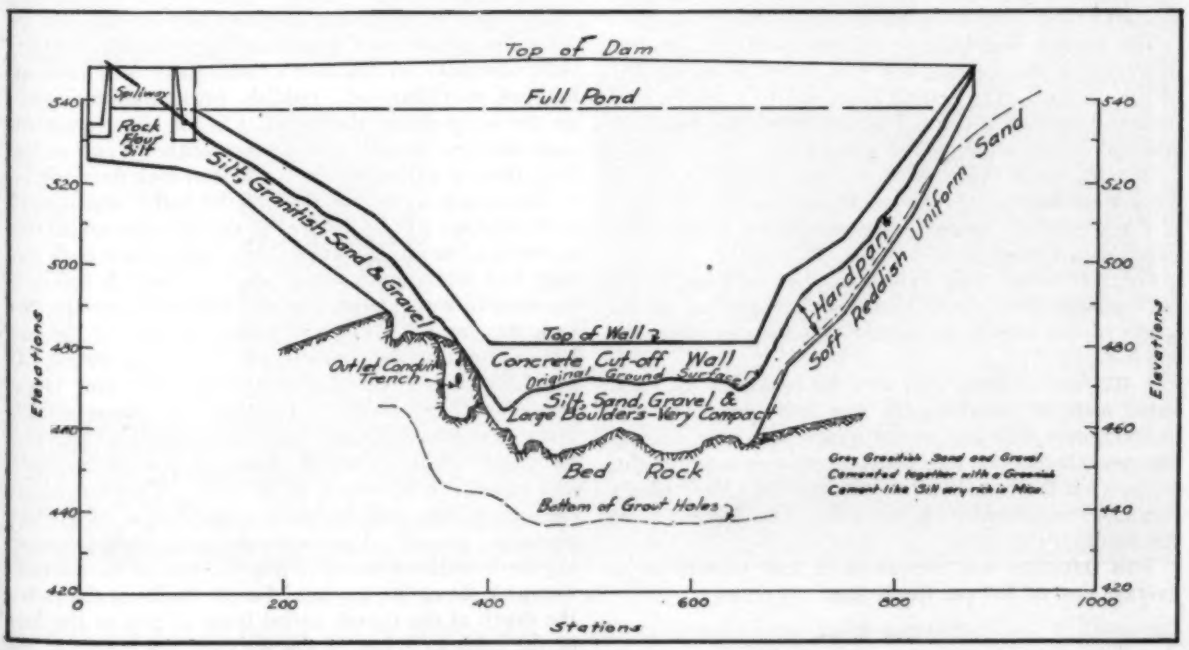
Order of Operations

The order of operations decided upon at the beginning of the work required the completion of all concrete work and a small amount of the embankment during 1928. Although it was necessary to do much more rock excavation and concrete work than was originally planned, due to the character of the foundation material, all of the concrete work was practically completed and also about one-quarter of the embankment.

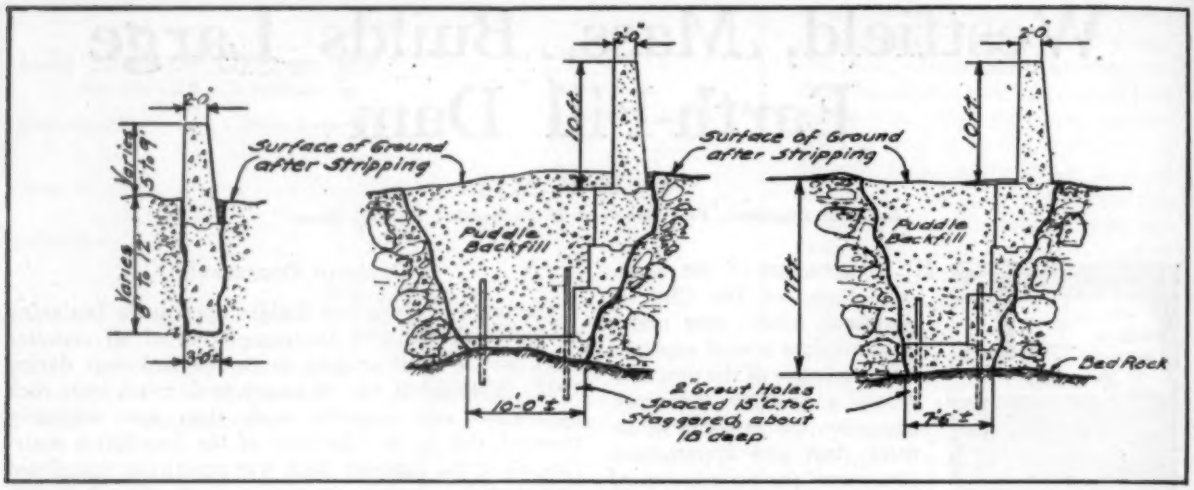
Work was first started at the dam on the outlet conduit. The construction of the cut-off wall, the preparation of the dam site for the embankment and the construction of the upper gate house then followed, and this work was carried on simultaneously. During the latter part of the season, the excavation of the road on the south bank of the dam, the construction of the spillway and spillway channel and the lower gate house was nearly completed; the borrow pit was opened and the earth embankment completed to an average height of 6 feet; a considerable amount of work was done in preparing the reservoir site for the storage of water, and the 20-inch supply main was completed.

Outlet Conduit

The outlet conduit consists of a reinforced concrete pipe 42 inches in diameter, and a 24-inch cast iron pipe embedded in concrete, about 740 feet long, built in a rock trench varying in depth from 3 feet, outside the



Profile of the Cut-Off Wall of the Granville Dam



Typical Cross Sections of the Cut-Off Wall

dam, to 25 feet, and averaging about 15 feet. The flow of the brooks is diverted into the conduit through a special inlet structure, and is discharged into the old brook channel a considerable distance below the dam. The conduit passes through the upper gate house, where gates will control the flow of water in it.

The construction required especial attention, as it was necessary to establish the profile as the trench excavation progressed. The rock encountered for the entire length of the conduit was granitish gneiss, traversed by many seams in a very irregular manner, and in many places badly disintegrated. This not only made the excavation much more costly to the contractor, as a large amount of rock was excavated without blasting, but it was necessary to remove much more rock and use much more concrete than originally anticipated. Only light charges for blasting were permitted by the specifications, and this specification was strictly enforced. The depth of all holes average only 2.6 feet, and the amount of dynamite used was kept to a minimum.

The conduit was built in sections averaging 40 feet in length. Concrete was first poured to the spring line of the conduit. The second pour was to a height of 9 inches above the crown. The cast iron pipe was then laid and the concrete poured around it.

Wooden forms were used for the 42-inch conduit. They were built semi-circular, in sections 10 feet long, of 2 x 8-inch ribs spaced 2 feet on centers, lagged with ⅞ x 1⅞-inch stock.

Concrete collars were built about every 30 feet at the bottom and sides of the trench and to the top of the banks of the trench, to prevent any seepage along the conduit.

A 400-foot cableway was used for removing the excavated material, handling the cast iron pipe and other material over that part of the trench where the excavation was the deepest. A Byers crane was used for this purpose on the remainder of the trench. Most of the concrete was poured from portable mixers located along the bank.

This structure was completed in four months at an average cost of $67 per linear foot.

CUT-OFF WALL

It was thought, previous to construction, that only a simple cut-off wall would be required. The contract drawings called for a concrete wall to be built across the floor of the valley in as narrow a trench as possible, resting on bed rock and extending above the surface of the ground about 5 feet. As bed rock is very deep on the banks of the valley, it was planned to use timber sheet piling together with a simple wall there, or an earth cut-off. Timber piling could not be driven, and it was decided to build the cut-off of concrete for the entire length of the dam.

Excavation for the cut-off wall was first started on the south side of the floor of the valley. As soon as bed rock was encountered, it was tested for watertightness. One-inch holes 10 feet deep took water at the rate of about 5 gallons per minute under a 20-foot head at the bottom of the hole. This fact, together with knowledge obtained regarding the character of the rock from the outlet conduit excavation, caused a change in the design of the wall.

The material overlying bed rock, across the floor of the valley, is silt, sand, gravel and large boulders, and is very compact; on the north bank there is a layer of hardpan overlying soft, reddish, fairly uniform sand; on the south bank, the material is silt, grey granitish sand and fine gravel; and at the southerly end of the dam, there is a considerable amount of rock flour silt.

The trench across the floor of the valley was opened to an average width of 8 feet at the bottom and 20 feet at the top, but on the banks of the valley the trench was kept to a minimum width of about 3 feet. A seal coat of concrete was poured over the bed rock and the bed rock was grouted. The wall across the floor of the valley was built on the downstream side of the trench. It was built in sections 40 feet long, and that part below ground surface was built in steps. Walls were built across the trench at the end of each section, enabling the puddle backfill, which consisted of rock flour silt and topsoil, to be placed in sections. The wall across the valley was built to an average height of 10 feet above the ground. Particular care was taken in grouting the foundation and building the wall at its intersection with the outlet conduit. On the banks of the valley the depth of the trench varied from 12 feet at the foot of the bank to 9 feet at the top, and the height of the wall above the ground surface varied from 10 feet at

the foot of the bank to 5 feet at the top. Passageways were left in the wall for use later in hauling the material to the dam for the embankment.

The entire length of bed rock was grouted. A set of 1-inch drill steel was used, which gave the diameter of hole at the top of about 3 inches. The holes were spaced 15 feet center to center in two lines about 7½ feet apart and the location of the holes were staggered. A total of 60 holes were drilled, 52 of which accepted grout. At the beginning of the operation the grout was mixed in the proportion of 1 part cement and 7 parts water. As the hole tightened the mix was increased to 1 part cement and 3 parts water. The grout was first applied under a pressure of 15 pounds and gradually increased to 80 pounds. The minimum amout of cement used per hole was ½ bag, the maximum 75 bags and the average 10¼ bags. A very small amount of grout was lost. The total cost of grouting was $2,475, or about $4.25 per linear foot of hole.

At the present time the cut-off wall is practically completed. Four months were required to build the wall, and the average cost per linear foot was $92.

UPPER GATE HOUSE

The upper gate house is a reinforced concrete structure 22 x 30 feet, and approximately 85 feet high with a one-story brick superstructure. It consists of a drywell and a wetwell. The wetwell does not extend to the very bottom of the structure, there being a large section of mass concrete about 28 feet high underneath it. The reinforced walls for a height of 28 feet above the foundation are 4 feet thick; and above this they are 3 feet thick.

This structure was built on a rock foundation of the same character of rock as was encountered in the outlet conduit trench. It was necessary to excavate more rock and to place more concrete than was originally estimated. The concrete in this building was placed in pours as large as practical, averaging about 100 cubic yards per pour. The concrete for the lower part of the structure was poured by gravity from a mixer located on the south bank; that in the middle part of the structure was handled from the mixer by a crane. A steam hoist elevator was used to handle the concrete above this elevation. The forms consisted of 2- x 6-inch spruce planed on one side with 3- x 4-inch studs 2 feet center to center and 4- x 6-inch ribbons, 3 feet center to center. The forms were double wired 3 feet center to center both ways.

The progress of the work depended upon the con-

CONSTRUCTION SCENES AT THE GRANVILLE DAM

1. Cut-off wall at its intersection with the outlet conduit. 2. The cut-off wall on the south bank of the valley. 3. The upper gate house measuring 22 x 30 feet in plan and 85 feet high before the erection of the one-story brick superstructure. 4. Loose boulders encountered in the stripping operations at the dam site were used in building the stone toe of the dam.

struction of the forms, and as only a limited number of men were able to work on the forms at one time, the construction of the building progressed slowly.

The total cost of this structure will average about 95 cents per cubic foot of gross volume.

MAIN DAM

The dam is an earth embankment built by the layer fill method, with a stone toe and heel, and stone facing on the up-stream slope. The materials used include: 240,000 cubic yards of earth, 30,000 cubic yards of stone, 8,000 cubic yards of gravel and 2,000 cubic yards of soil dressing. The stone embankments and facing have been laid out to utilize all of the stone excavated for appurtenant structures and all stone encountered in the borrow pit. The average cost per cubic yard of the entire embankment will be about 85 cents.

PREPARATION OF THE SITE

The first work in the construction of the main dam was the preparation of the site for the embankment. This work included the removal from the site of all stumps, topsoil, loose boulders, and material which in its natural state was quite permeable. A large part of this work was done by a steam shovel. The final operation of cleaning up the loose material left by the shovel was done by hand labor. This work progressed slowly at first, due to the difficulty of hauling the material away. The Linn tractor was of particular value, having no difficulty in hauling a full load over rough ground on a 20 per cent grade.

Many boulders were encountered in the stripping of the site. It was necessary on account of these boulders to do a large amount of the work by hand labor. All loose boulders were removed for use in building the stone toe of the dam.

WORK AT THE BORROW PIT

While the work in preparing the dam site was under way a road was excavated to the borrow pit, and a part of the pit was grubbed and stripped. The pit is located on the north bank of the valley about one-quarter of a mile from the center of the dam. It is on a side hill with an average cross slope of about three to one.

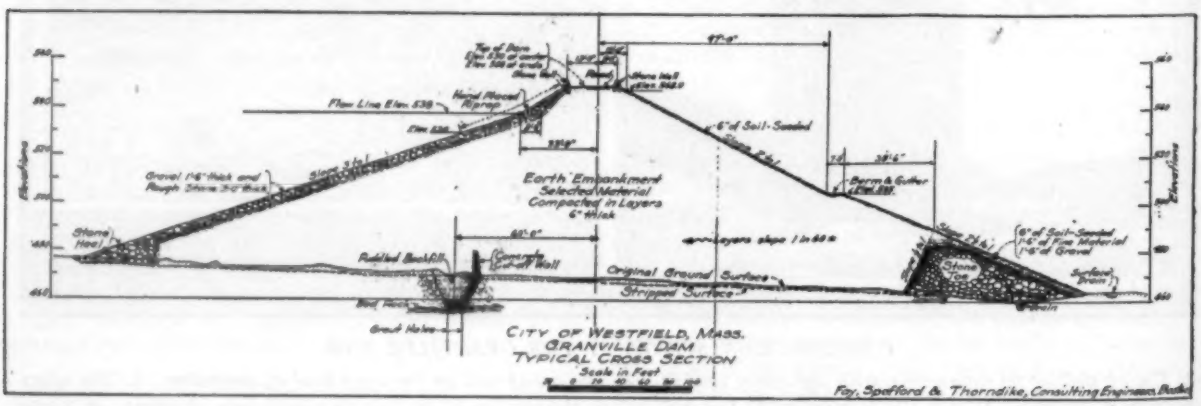
Investigations, conducted previous to construction and since proved to be correct, showed that this side hill was covered by a layer of hardpan approximately 10 to 15 feet thick at its junction with the floor of the valley and 60 to 80 feet deep at the top of the hill. Underlying the hardpan there is a large volume of uniform reddish, micaceous sand which is very permeable, and therefore unsuitable for the earth embankment.

The contract permitted the contractor to open the borrow pit in any location he deemed desirable on the side hill, but not nearer than about 300 feet from the embankment. He elected to open the pit at about elevation 550, about 10 feet above the top of the dam, where the depth of the overlying hardpan would be great enough to permit the economical excavation and handling of the material. The road from the pit to the floor of the valley at the dam site is on an average grade of 10 per cent. As the height of the embankment increases the alignment of the road will be changed somewhat, thus decreasing the grade of the road.

The excavation in the pit is being carried to the entire depth of the good material. It is being made by two Byers steam shovels, equipped with ¼-yard buckets. These shovels are capable of excavating the bank to a height of about 25 feet. It was first planned to terrace the cuts with depths not greater than could be made by the shovels in one cut, but this idea has been abandoned, due to the difficulty of handling the hauling equipment in the pit. When the height of the bank reaches about 25 feet, a cast-over cut is made from the top of the bank by a Byers gasoline shovel equipped with a one-yard bucket. This shovel casts the material over the bank, where it is rehandled by the steam shovels before another cut into the bank is made. It is not necessary to use the gasoline shovel on this work all of the time.

The hardpan is very difficult to excavate. The teeth of the buckets are made of manganese steel, but it is necessary to change them frequently. The excavation of this hardpan could be done more economically by larger and more powerful shovels, but the sizes of the shovels being used fit in very well with the general scheme of handling the material. They are quite speedy and capable of excavating the material as fast as it can be properly handled at the embankment. If larger shovels were used, additional spreading, rolling and hauling equipment would be required.

During the past season the steam shovels worked 104



A Typical Cross Section of the Granville Dam

OPERATIONS IN THE BORROW PIT

At left, two Byers ¾-yard steam shovels excavating material for the earth dam and, at right, a Byers one-yard gasoline shovel casting material over the bank for rehandling by the steam shovel below.

shovel days, averaging about 600 cubic yards per shovel per day. The last month of the work they averaged about 760 cubic yards per day. These figures do not represent the maximum capacity of the shovels, as all of the equipment for hauling the material to the dam did not arrive until the last few days of last season. It is expected that during the present season these shovels will average about 900 cubic yards per working day.

HAULING OF MATERIAL FROM THE BORROW PIT TO THE EMBANKMENT

At the beginning of the work the contractor was undecided on the type of equipment to use for hauling the material from the pit to the dam. Numerous types were considered; namely, belt conveyors and trucks, motor trucks, Linn tractors, and tractor trains. The contractor purchased a 7-ton Linn tractor for general use on the job, and as soon as the earth embankment was started, this machine started hauling from the pit. A 60-horsepower Caterpillar tractor and two La Plant-Choate steel bottom dump wagons were purchased on trial. Three-ton Mack trucks equipped with dual-pneumatic tires on the rear wheels were hired. Time studies were made to determine the comparative cost of hauling the material by these machines. These studies were made at the beginning of the work when hauling conditions at the embankment were poor, and at a time when the pit was not large enough to permit the easy handling of the equipment there. The study shows that the earth can be hauled much cheaper by tractor trains, the cost per cubic yard averaging about 12.5 cents, while the cost for the Linn tractor is 19.5 cents, and the cost for the trucks is 22.5 cents per cubic yard.

The results of this study proved conclusively to the contractor that the tractor trains should be used, and consequently additional tractors and wagons were ordered at once. As the hauling conditions at the embankment and in the borrow pit improved, it was found that the Caterpillar tractors could haul three wagons and the Linn tractor could haul in addition to her usual load one wagon, and therefore additional wagons were ordered. At the end of the season the material was being hauled by three tractor trains of three wagons and by the Linn tractor and one wagon. It is expected that the remainder of the filling material will be hauled by this equipment only. The cost of hauling the material with trains of three wagons and with the Linn tractor and one wagon will, of course, be much less than that shown in the tabulation. The cost per cubic yard for the trains will be about 9 cents and for the Linn tractor and one wagon about 13 cents. The figures are not total costs, as they do not include the contractor's overhead and other general charges.

TIME STUDIES AND COST OF HAULING EARTH FROM BORROW PIT TO EMBANKMENT

Equipment	No. of Trips	Average Time Per Trip: Loading	Lost	Hauling	Total	Trips Per 9 Hr. Day	Total Cost of Equipment Per 9 Hr. Day	Cubic Yards Hauled Per 9 Hr. Day	Cost Per Cubic Yard
Tractor Train No. 1	30	5'-34"	4'-04"	8'-28"	18'-06"				
Tractor Train No. 1	38	4'-13"	0'-34"	9'-02"	13'-49"				
Tractor Train No. 2	18	5'-13"	3'-30"	9'-47"	18'-30"				
Average for Trains					16'-48"	32	$40	330	$0.125
Truck No. 3	52	1'-37"	3'-19"	6'-47"	10'-43"				
Truck No. 4	52	1'-44"	2'-13"	6'-57"	10'-56"				
Truck No. 4	49	1'-23"	2'-20"	7'-05"	10'-48"				
Truck "A"	32	1'-19"	1'-50"	7'-36"	10'-45"				
Truck "A"	47	1'-25"	2'-19"	7'-48"	11'-32"				
Average for Trucks					10'-57"	40	$27	122	$0.225
Linn Tractor	28	3'- 0"	0'-34"	7'-45"	11'-19"				
Linn Tractor	21	2'-46"	0'-55"	11'-39"	15'-14"				
Average for Linn Tractor					13'-17"	41	$36	184	$0.195

A Train consists of a 60-horse-power Tractor and 2-6 Cubic Yard Dump Wagons.
Capacity of Truck—3 Tons.
Capacity of Linn—7 Tons.
Total Haul—½ Mile.

WORK ON THE EMBANKMENT

The work at the embankment consists of spreading and rolling of the material and the sorting from the earth of roots over ½-inch in diameter and stones over 6 inches in the greatest dimension. A 60-horsepower Caterpillar tractor, equipped with a LaPlant-Choate bulldozer, is used for spreading the material. A 7-ton Buffalo-Springfield roller is used to assist the other equipment in compacting. A 1½-ton truck, a foreman and 5 men are used to sort the roots and stones, direct the dumping of the earth and the placing of the stone and gravel.

The Lower End of the Spillway Channel on the Granville Dam Project

Amount of Compacting

Perhaps the most essential factor to consider in building earth embankments is the compactness of the mass, as the greater the compactness the greater the weight, and in most cases the greater the imperviousness.

The specifications for this job require

"the filling material shall be distributed in approximately horizontal layers not exceeding six inches in thickness when compacted. . . . The compacting shall be done by approved rollers having grooved or banded rolls and operated by mechanical power except that in small embankments and around the structures other means approved by the Engineer may be used. The heaviest wheels of the roller shall cause an average pressure of at least two hundred fifty pounds per linear inch width of roll. The roller shall pass over every portion of each layer as many times as may be necessary, but not *less* than six times in any case."

This specification conforms closely with the specification commonly used for the building of layer-filled embankments.

Numerous test pits have been dug in the embankment. Below a depth of one foot it is impossible for a laborer to dig the material without the use of a pick. Laborers say that it is as difficult to dig as any natural material they have ever dug.

Soil Tests

The various kinds of soil encountered are tested in the field office by a method worked out by Dr. Charles Terzaghi, of the Massachusetts Institute of Technology. The method involves the use of a device for measuring the capillary rise of water in soil. Careful records are kept of the coefficient of permeability, volume of voids, voids ratio, and so forth, of the soil used in the embankment.

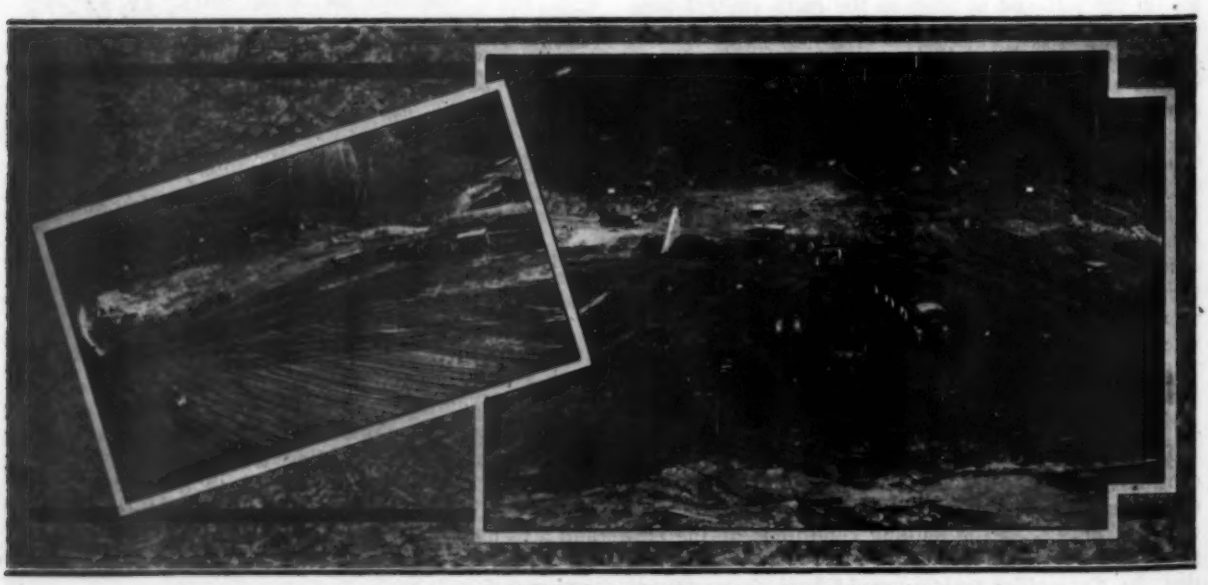
Drains

A system of pipe drains has been built underneath the stone toe, the main drain of which passes through a catch basin just below the dam. Ditches which will collect the surface drainage on the face of the dam will discharge into this catch basin. A weir has been built in the catch basin so that the amount of leakage through the dam can be measured. Weirs have also been built on each brook at the head of the reservoir. During the construction period daily records are kept of the flow of water over these weirs, and also the flow of water in the brooks after they join at the mouth of the outlet conduit. If records are kept of the amount of water used from the reservoir after construction and the amount of water entering the reservoir, together with the heights of the reservoir, and the amount wasted, the approximate amount of leakage through the walls of the reservoir may be determined. Such a figure will be of particular value to check the estimates made of the leakage by the geologists.

Miscellaneous Structures

The lower gate house, a small structure 16 feet by 20 feet, consisting of a concrete basement and brick superstructure, houses gates which will control the flow of water in the supply main. Provisions have been made in the layout of the piping so that the water may be returned to the brook or to an aeration plant, which may possibly be needed.

The supply main extends from the lower gate house



Work on the Earth Embankment, Showing the Dumping, Spreading and Rolling Operations

Equipment	Number of Machines	Total Width of Treads	Distance Travelled on Embankment (Feet)	Area Covered By Treads (Sq Ft.)	Wheel & Tractor Loads (Pounds) Total			Per Lin. In. Width of Tread			Average Number of Trips*	Trip Pounds Per Linear Inch Width of Tread
					Loaded	Empty	Average	Loaded	Empty	Average		
Roller	1											
Front Wheels		37"	35,000	108,700	4,960	4,960	4,960	134	134	134	1.04	140
Rear "		36"		104,300	9,900	9,900	9,900	275	275	275	1.00	275
Caterpillar Tractor	3	32"	18,150	145,500	29,000	29,000	29,000	625	625	625	1.39	870
Caterpillar Tractor with Bulldozer	1	32"	70,000	187,000	27,140	27,140	27,140	850	850	850	1.79	1,525
Wagons	10											
Front Wheels		20"	18,150	303,000	8,000	2,440	5,220	400	120	260	2.91	755
Rear "		24"		363,000	15,350	4,710	10,030	640	200	420	3.48	1,460
Linn Tractor	1	28"	18,150	42,300	28,250	9,250	18,750	1,010	330	670	0.41	272
Total Relative Amount of Compacting												5,297

* The average number of trips is the ratio of the area covered by the treads to the area of embankment

Tabulation, Showing the Relative Amount of Compacting Done by Rolling, Spreading and Hauling Equipment for One Compacted Layer 5½ Inches Thick

along the brook a distance of one-half mile to a connection with an existing main. It is a 20-inch cast iron pipe laid in a trench with an average depth of 7½ feet, located on a steep side hill. The total cost of this pipe line per linear foot was about $11.50.

The spillway and spillway channels were built on the steep south bank of the valley. At the upper end a large amount of rock flour silt was encountered, and the sides of the spillway are gravity retaining walls. Sand, gravel and rock were encountered most of the distance and the slopes of the channel are paved. Rock was encountered at the lower end of the spillway where the alignment is on a curve. The channel was built in sections 30 feet long and on chords around the curves. Movable forms were used for the slope paving. At the lower end of the channel difficulty was had in hauling the excavated material from and hauling the construction material to the channel, as the grade here is 18 per cent. The only hauling vehicle which could operate on this grade was the Linn tractor.

A road has been excavated from an existing road to the south end of the bridge. This road will cross the spillway and the dam. A pony truss bridge with a concrete deck has been built across the spillway. The steel for the bridge was fabricated in Worcester, and the trusses, 60 feet in length, were transported via highways to the site. Only a small amount of trouble was had navigating the truck and trailer around the sharp curves approaching the job.

A considerable amount of material excavated from the road and spillway channel was not suitable for use in the embankment. This material was used for blanketing swampy places in the reservoir. In connection with the preparation of the reservoir site for the storage of water, some work has also been done stripping the flow line. Most of the material on the banks of the reservoir is sand and gravel. A Byers gasoline shovel has been used in making a single cast-over cut along the flow line. This results in thorough stripping for a depth below the flow line of about ten feet and blanketing a similar depth below the cut. This scheme of treating the flow line eliminates a great amount of hauling of the stripping material and leaves the shores of the reservoir in a much better appearance.

TYPE, MAKE, SIZE AND COST OF EQUIPMENT USED

EARTH EXCAVATING MACHINERY

Machine	Makers	No.	Rating	Cost	Remarks
Gas Shovel	Byers	1	1 Cu. Yd.	$ 15,500	With 50 ft. boom and dragline equipment
Steam Shovel	Byers	2	¾ Cu. Yd.	24,000	
Bear Cat	Byers	1		8,500	With 30 ft. boom skimmer, ditcher and ½ cu. yd. Owen clamshell bucket
Tractor	Caterpillar	1	"60"	6,450	
Tractor	Caterpillar	2	"60"	14,700	
Trailers	La Plant-Choate	10	5 Cu. Yd.	12,000	Bottom Dump
Tractor	Linn	1	6 Cu. Yd.	8,200	Dump Body
Grader	Wehr	1		1,400	Fordson Power
Roller	Buffalo-Springfield	1	7 Ton	3,500	4 Cylinder Gas
Total				$ 94,500	

CONCRETE MACHINERY

Mixer	Rex	1	3 Bag	$ 2,200	
Mixer	Lakewood	1	4 Bag	3,100	
Mixer	Lakewood	1	2 Bag	1,450	
Mixer	Rex	2	1 Bag	1,950	
Sand Loader	Conant	1		300	
Totals				$ 9,000	

MISCELLANEOUS EQUIPMENT

Lighting Plant	Koeler	1	900 W.	$ 500	Automatic Generating
Cableway		1	400 Ft.	3,500	Steam Boiler
Compressor	Gardner-Denver	1	220 Cu. Ft.	3,300	
Compressor	Ingersoll-Rand	1	160 Cu. Ft.	2,650	
Stone Drills	Ingersoll-Rand	6		1,020	Air Driven
Stone Drills	Gardner-Denver	3		570	Air Driven
Truck	Indiana	1	1 T.-1 Cu. Yd.	1,800	Dump Body
Truck	Indiana	1	1½ T.-1½ Cu. Yd.	2,350	Dump Body
Truck	Indiana	1	3 T.-3 Cu. Yd.	3,500	Dump Body
Grout Mixer		1		375	
Pumps	Gould	2	4" x 5"-21 g. p. m.	900	21 g. p. m. at 175 ft. head
Total				$ 20,465	
Grand Total				$123,715	

GENERAL

The contractor, the C. & R. Construction Co., of Boston, has cooperated fully at all times with the engineers on this project. The job has been exceptionally well equipped at all stages of the work. The total cost of all equipment used amounts to $124,000. Fay, Spofford & Thorndike, of Boston, Mass., are the consulting engineers.

ACKNOWLEDGMENT.—From a paper presented before the New England Water Works Association.

Economics of Highway Bridge Types

A 246-PAGE volume under the authorship of C. B. McCullough, M. Am. Soc. C. E., and Bridge Engineer, Oregon State Highway Commission, has recently been published. This book covers general factors controlling the type selections, both as regards the streams to be bridged and traffic, architectural and scenic considerations, economics analyses, first-cost data, short span superstructures, long span superstructures, substructure types, unit costs, and a chapter on illustrative problems in type selection. The book is offered by the Gillette Publishing Co. Price, $5.00.

A 24-Foot Highway Through Heavy Redwood Timber

By M. H. Hubbs

Resident Engineer, Division of Highways, California State Department of Public Works

CONTRACTORS have completed two contracts from Orick, Humboldt County, Calif., to the Del Norte County Line, eliminating 15 miles of rough winding road through the dense redwood forests and cutting one hour from the driving time between Eureka and Crescent City, Calif. The road has a 24-foot crown increased to a 30-foot crown width in the low country and is surfaced with crushed gravel 20 feet wide. It was constructed at a cost, including the heavy clearing, of approximately $600,000.

The Englehart Paving & Construction Co., was awarded the contract for clearing and grubbing the 15-mile project, consisting of 65 acres of trees, stumps and fallen logs which were larger than 12 inches in diameter. All tree stumps and logs under 12 inches in diameter were included in the grading contract which were awarded to W. H. Hauser, Oakland, Calif., from Orick to Russ Grove, 8.5 miles, and the Englehart Paving & Construction Co., Eureka, Calif., from Russ Grove to the Del Norte County Line, a distance of 6.5 miles.

Heavy Clearing

Practically all of the project lay in dense redwood forests, almost impenetrable, with immense fallen logs, heavy underbrush, and redwood trees up to 14 feet in diameter. The falling of these large trees, the blasting of the stumps and their removal from the construction limits was a problem made more difficult by the litter of the fallen logs, some of which had laid for hundreds of years partly buried, while trees 6 feet in diameter had grown on top of them.

The felling was done by 16 choppers in sets of two to each tree. The choppers were followed by the buckers or sawyers, with drag saws, who cut the logs into merchantable lengths suitable for handling. The buckers were followed by the powder men who blasted the stumps. The logs and stumps were then removed by the blocking crew.

Six months were required by four crews of blockers with ten men to a crew, to complete the removal of 1,900 trees from 65 acres. Each crew was made up as follows: for blocking, one 9 x 11 spool steam donkey engine, one donkey operator, one spool tender, two riggers, four hook tenders, one wood buck and one water buck; for felling, sixteen choppers, bucking up, four sawyers, and two drag saws; for stumping, one powder man, and seven helpers.

The clearing cost, including material and equipment, was as follows:

Felling	$9,250
Bucking up	5,658
Stumping	18,974
Blocking	50,122
Total	$84,004

The average total cost per acre was $1,292.37 and the average cost per tree was $45.15 or $7.11 per thousand board feet of standing timber.

The number of trees separated into sizes and their average approximate cost per tree, were as follows:

				Average Cost Per Tree
486	trees	12 to 20	inches diameter	$16.65
416	"	21 to 30	" "	26.35
288	"	31 to 40	" "	38.10
328	"	41 to 60	" "	52.85
124	"	61 to 80	" "	74.30
118	"	81 to 100	" "	93.70
101	"	101 to 220	" "	171.65

Forty tons of powder were used in blasting the stumps at an average cost of $6.45 per stump or an average of 15 cents per inch diameter of tree. Many of these stumps were from 10 to 20 feet in diameter at the ground.

Grading

The material on the northern half of this project, the Englehart contract, contained clay, which, due to numerous fogs, never completely dried out and the contractor was confronted with the problem of hauling the material away from his shovels over practically impassable roads. Five-yard dump trucks were quickly discarded as too heavy. Ford 1½-yard trucks were used with some success, but they quickly cut ruts requiring continuous maintenance in order to haul at all.

Fordson 1½-yard iron mules were then used and proved very successful. The wide wheels ironed out the spongy subgrade and little maintenance work was necessary. Four of these iron mules were sufficient to keep one shovel going, hauling from 300 to 1,000 feet and handling from 300 to 350 cubic yards per shift.

Surfacing

Rain falls in this part of Humboldt County eleven months out of twelve, making the construction of a suitable subgrade a difficult and expensive problem. Heavy fogs kept the subgrade in a wet condition between showers. In some cases suitable material for decking was obtained for placing on the worst places, but this decking material was scarce and, as a rule, it was a matter of fighting the mud. Surfacing operations were suspended for five months during the winter.

Underground water was encountered on the northern portion and the subgrade at these places was drained by tile drains placed at the side of the road, parallel to the center line and three feet below the subgrade. About 4,000 feet of 6-inch tile drain was placed.

PROGRESS OF CONSTRUCTION THROUGH REDWOOD TIMBER LAND

1. *The old road.* 2. *Clearing the way for the new highway.* 3. *Mammoth stumps that were removed.* 4. *The new highway completed and open to traffic*

TRAFFIC CONDITIONS

One of the most important problems involved in this project was the carrying of traffic through the construction without interruption. While traffic is much heavier on many other highways throughout California, few, if any, suffered the congestion which occurred on this 15-mile stretch of one-way road with widely separately turn outs and frequently blocked by construction operations. From 400 to 500 machines was the daily average during the months of June, July and August, requiring a force of seven traffic officers. These men were appointed by the Motor Vehicle Department of the State, but worked under the supervision of the Resident Engineer.

Two strings of cars, each in charge of two traffic officers left each end of the job simultaneously, passing at a designated point about half way. Two officers acted as flagmen at each end and the seventh patrolled the road, directing and giving assistance to such stragglers as had dropped out of line on account of tire or motor troubles.

Dust at times became bothersome to the drivers in the long strings of machines and it became necessary to sprinkle the road, which required two water wagons, 8 hours per day each. Long lines of machines cut the road up badly, which made frequent blading necessary.

The cost of handling traffic, including this maintenance work, was $13,200 or about 3½ cents per cubic yard of excavation and about 10 cents for each car conducted through the work during the existence of the patrol system.

ACKNOWLEDGMENT: From an article appearing in *California Highways and Public Works*, the official journal of the Division of Highways, California State Department of Public Works.

Trouble with Suspension Bridge Cables

THE new heat-processed cable wire, which has been used on the Mount Hope suspension bridge connecting Bristol and Portsmouth, R. I., and also on the Ambassador bridge, between Detroit and Windsor, Canada, has shown a large number of breaks in the individual strands. The official statement, issued by C. Philip Coleman, President of the Mount Hope Bridge Co., follows:

"On account of the defects that have developed in the cables of the Mount Hope Bridge our engineers have condemned the cables and have ordered their prompt removal and replacement. This step, although it will mean an appreciable delay in the opening of the bridge, is endorsed and approved by the officers of the Mount Hope Bridge Co., and by the contractors.

"Our contractors, the McClintic-Marshall Co., have assured us that they will do all that is necessary to deliver the completed bridge in condition and form entirely satisfactory to us and our engineers. By reason of the fact that the necessary revision is difficult and unusual it is impossible to determine definitely the time that will be required. It is now estimated that there will be a delay of approximately six months. If this is correct the bridge will be opened about November 15, 1929, instead of May 15."

Protection and Safety Work

Committee on Accident Prevention of the Building Trades Employers' Association of New York Completes Helpful Safety Specifications

A SPECIFICATION entitled "Protection and Safety Work" has recently been issued in new form by the Committee on Accident Prevention of the Building Trade Employers' Association of New York, as another step in its campaign to reduce casualties on construction work in New York. This specification which is now in the same form as the contract documents of the American Institute of Architects to make it convenient for use by both architects and builders, contains provisions which the committee considers important for safeguarding the work to prevent injury to the workmen. The articles of the specification include much valuable information and are as follows:

The owner and/or contractor shall install and maintain all of the safeguards enumerated in Articles 1 to 15 inclusive, of this specification and shall comply with the requirements of all laws and ordinances in force in the locality where the work is situated relative to the safeguarding of the work to prevent injury to persons. All safeguards shall be constructed in accordance with the requirements of such laws and ordinances. Sizes and other details specified shall be considered as the minimum requirements and shall be modified and extended to comply with any existing law or ordinance. When a situation arises where two or more of these safety rules may apply and there is doubt as to which one should be used, the rule which is the more practicable and which affords adequate protection may be followed. The following rules describe safety measures to be employed for the prevention of accidents:

ART. 1. FIRST-AID.—Provide and maintain an ample supply of iodine or mercurochrome and asceptic gauze bandages in a suitable cabinet.

ART. 2. LADDERS AND TEMPORARY STAIRS.—Install and maintain ladders or temporary stairs of ample strength to give access from one floor to another after the structural flooring is in place and until the permanent stairs are available. Such ladders or temporary stairs shall be of such size and so located as to give proper facilities to all workmen engaged on the work. The side rails of each ladder shall extend at least thirty-four (34) inches above the platform or floor it serves and when required, ladders should be made at least four (4) feet wide with three stringers. Temporary stairways, if installed, shall be provided with substantial handrails.

All intermediate landings shall be substantially constructed without openings between the planks and all intermediate landings and ladder openings in the floor shall be enclosed by a railing and a toe board as described below under heading "Floor Openings" so that a person can not step into the ladder shaft except at the openings provided for the ladders.

Also provide similar ladders before the structural floors are started and above the top floor on which the structural flooring has been placed. Each ladder shall be secured against slipping and shall extend at least thirty-four (34) inches above the floor or platform it serves. At top and bottom of each ladder provide solid wood platforms at least two (2) feet longer than the width of the ladder and with an approximate width of three (3) feet.

ART. 3. PERMANENT STAIRWAYS.—Stairwells for permanent stairways shall be guarded on all open sides with railings and toeboards as described below under "Floor Openings" and all permanent stairways shall be provided on open sides with substantial temporary planed wood handrails, thirty-six (36) inches in height, measured from the center of the tread.

Stairways on which treads and landings have to be filled in later with cement or other filling material shall have temporary wooden treads and landings, or other equally suitable material, to the height of the nosing, full width of the tread and landing, firmly fitted in place and replaced when worn below the level of the metal nosing. Where skeleton iron stairs are installed, they shall have wooden treads and landings not less than two (2) inches thick. All treads and landings shall be free from protruding nails and splinters.

ART. 4. PERMANENT OR TEMPORARY ELEVATOR CAR USED FOR CARRYING WORKMEN.—Where a permanent or temporary elevator car has been installed and is used during construction for carrying passengers, the hoistway shall be completely enclosed in partitions not less than eight (8) feet high, and all openings therein fitted with doors locked on the hoistway side. The car shall be fully and substantially enclosed on all sides, including the top, except as required for entrances.

ART. 5. FLOOR OPENINGS.—All openings in floors (except such as are necessary to be opened for immediate use) shall be protected by guardrails approximately forty-two (42) inches high with uprights not less than two by four (2 x 4) inches, spaced not more than eight (8) feet apart. The top rail shall be not less than two by four (2 x 4) inches or equivalent section and the mid-rail not less than seven-eights (⅞) inch by four (4) inches. Each guardrail shall be provided with a toeboard, not less than seven-eights (⅞) inch by six (6) inches, placed on edge. As an alternate, small openings may be planked over in a substantial manner.

ART. 6. GUARDING MATERIAL HOIST SHAFTWAYS.—Two sides of all material hoist shaftways shall be enclosed at each floor to a height of not less than eight (8) feet, with wire netting of not less than No. 10 U. S. standard gage and not more than one and one-half (1½) inch mesh, or expanded metal of equivalent strength, secured to uprights so spaced as to afford a strong and substantial guard. Wood slats laid preferably horizontal may be used instead of wire netting with openings between slats not to exceed one and one-half (1½) inches. The guard shall extend, if practicable, two (2) feet beyond the sides of the shaftway. At two sides of the hoistway used for handling material, there shall be bars three (3) feet high bolted or otherwise secured at one end to the guard, and placed, where possible, not less than two (2) feet from the edge of the shaft opening. Such bars shall be not less than two (2) inches by three (3) inches, made of spruce or other approved material of equal strength. A toeboard at least seven-eights (⅞) inch by six (6) inches shall be installed on open sides when not being used for handling material.

ART. 7. CONCRETE BUCKET SHAFTS.—When a concrete bucket tower is located within the building, it shall be enclosed on all the sides which are less than three feet from the edge of the shaftway or opening in which it is installed, or on the sides where scaffolds may be erected, by attaching boards, wire netting or expanded metal to the frame work of the hoist tower, or to other suitable supports, leaving suitable openings for the bucket to dump. If wire netting is used, it shall not be lighter than No. 10 U. S. standard gage with not more than one and one-half (1½) inch mesh. If expanded metal is used, it shall be of equivalent strength and mesh. If wood slats are used, they may be laid vertically or horizontally, but the spaces between slats shall not exceed one and one-half (1½) inches.

When shaft is outside of the building, guardrails and toeboards shall be placed on sides of runways to hoist shaft, and side of shaft which faces the building shall be guarded as specified above, except space where bucket dumps.

ART. 8. SWINGING SCAFFOLDS.—Every scaffold swung from an overhead support, which is ten (10) feet or more above the ground or floor, shall be of ample strength, not less than twenty-seven (27) inches in width and provided with a substantial railing and toeboard along the outer edge. All ropes, cables and blocks supporting scaffold shall be capable of sustaining at least four times the maximum weight of the material and men to be placed on the scaffold, and means shall be provided to prevent the scaffold from swaying.

ART. 9. SUSPENDED SCAFFOLDS.—Platforms suspended by steel cables and operated by hoisting machines for the use of bricklayers and for similar use shall be supported by outriggers or other form of support equal in strength to seven-inch I beams having a weight of fifteen and three-tenths (15.3) pounds per foot. Outriggers shall be not more than nine (9) feet apart. The platform shall be made of sound plank not less than two (2) inches thick properly secured and laid close.

The outside of the platform shall be provided with a substantial railing of iron or wood not less than forty-two (42) inches high, and provided with a toeboard not less than nine (9) inches high. The space between the toeboard and the railing shall be filled in with wire netting of not more than three-quarters (¾) inch mesh. An overhead protective covering shall be maintained at such time as the platform is in use, at a height of not more than nine (9) feet above the working platform.

ART. 10. BUILT UP SCAFFOLDS.—All scaffolds shall be of ample strength to support the maximum number of men to be placed on same plus the weight of the material. Scaffolds more than fourteen (14) feet in height shall be provided with substantial railings thirty-four (34) inches high and toeboards nine (9) inches high on all edges which are not close to the walls. When a scaffold crosses a window or other opening which extends five (5) feet or more above the platform of the scaffold, a similar guard and toeboard shall be placed across the opening.

ART. 11. OUTRIGGER SCAFFOLDS.—Outriggers where projecting not more than six (6) feet from the face of the wall or building shall be sound yellow pine or spruce not less than three by ten (3 x 10) inches or other approved material of equal strength, and shall be well braced and secured to prevent tipping or turning. The platform shall be of sound yellow pine, spruce or other approved material of equal strength, not less than two (2) inches thick, laid close. The outside of the platform shall be provided with a substantial railing of iron or wood, not less than forty-two (42) inches high, and provided with a toeboard not less than nine (9) inches high. The space between the railing and the toeboard shall be filled in with wire netting of not more than three-quarters (¾) inch mesh.

ART. 12. SPECIAL SCAFFOLDS.—Construct and maintain suitable scaffolding of sufficient strength as may be required for exterior work on towers, spires, etc., and interior work in churches, theatres, auditoriums and the like.

ART. 13. ARTIFICIAL LIGHTING.—Install and maintain lighting for the under side of the protection over sidewalk; also for temporary illumination of the building. Suitable feeder lines should be installed extending from the bottom to the top of the building, and of ample capacity to properly provide for all spaces requiring light, and at the same time, service for all motors contemplated to be used. Install and maintain one light at each floor landing in fire tower and stairways and at such other places as may be necessary to properly light the stairway; also, in exits to streets, and on all elevator cars used for carrying passengers.

ART. 14. PLANKING DERRICK FLOOR.—Where structural steel is being erected, the derrick floor shall be entirely planked over.

ART. 15. SIDEWALK AND OVERHEAD PROTECTION.—Maintain safe sidewalks for the use of pedestrians including overhead protection for same with its outside columns secured against lateral displacement as required by laws and ordinances in force in the locality. Where an overhead sidewalk bridge is used for the storage of material, it shall not be overloaded.

Winter Curing of Concrete in Bridge Arch Rings

By S. W. Jackson

Division Engineer, Pennsylvania Department of Highways, Clearfield, Pa.

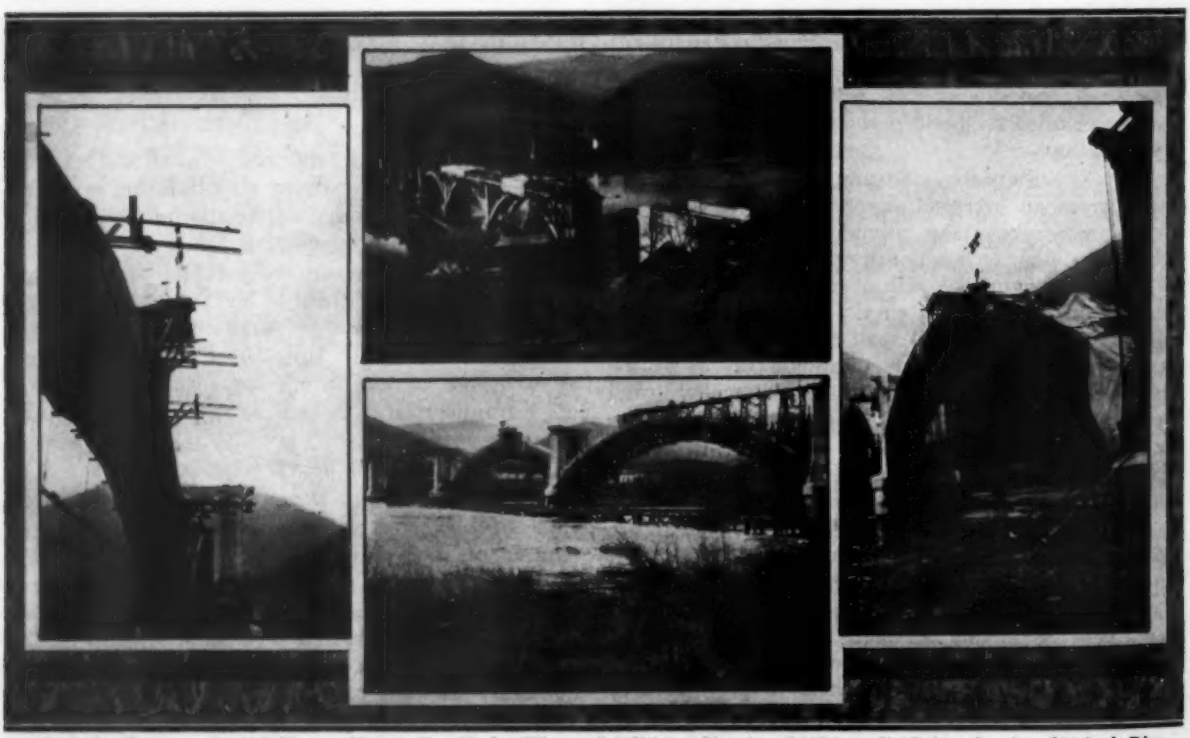
IN connection with the opening and improving of Pennsylvania State Highway Route 105 between Lock Haven and Renovo, the grading of which was described in the January, 1929, issue of CONTRACTORS AND ENGINEERS MONTHLY, the State Department of Highways is constructing a concrete bridge across the west branch of the Susquehanna River and over the tracks of the Pennsylvania Railroad at Hyner. The approximate overall length is 1,100 feet and the bridge is composed of five main river arch spans, each 162 feet in length with open spandrel walls and a shorter closed spandrel arch at each end. There are two separate arch rings in each of the main spans which support the deck floor. Due to delays on account of highwater and foundation troubles, the arch rings on only three of the main spans were completed during favorable weather and the arch rings on the last two spans have been poured and cured under tarpaulins and with live steam from boilers, supplemented by heat from salamanders.

FORMS AND PROTECTION

Forms for the arches were supported on steel centers and the forms and covering completed for the entire arch ring before the pouring was started. The form floor projected about 2 feet on each side so as to provide a walkway along each side of the arch ring. Side and overhead supports were placed so that the tarpaulins would clear the tops of the forms by at least 5 feet, to permit space for the workmen while placing the concrete. After the forms had been placed, the tarpaulin was stretched around the bottom and overlapped and sewed at the top. Flap openings were left at each end and at the crown of the arch for the convenience of the workmen and a flap opening was also provided for the entrance of the chute and concrete at the highest point in each section. Each arch ring was poured in 7 sections, the two haunches to about the quarter points first, followed by the crown, then the two sections between the quarters and the crown, and last the key section at each end at the piers.

HEATING OF AGGREGATE

The aggregates in the stock piles were kept securely protected from the weather and perforated steam lines through the stock piles were supplied with steam



Building the Concrete Arch Bridge at Hyner, Pa., Under Winter Conditions, Showing the Tarpaulin Protection for the Arch Rings

several days in advance of the work. The stock piles were not permitted to cool until the pouring was completed. When stone and sand were not being taken from the stock piles, they were kept covered with tarpaulins. The temperature of the material in the stock piles was kept at about 60 degrees Fahrenheit. The water was heated by a boiler and the temperature kept between 80 and 110 degrees. A blow torch flame was provided for use in the drum of the mixer and when mixing, the flame was used continuously. The concrete was mixed for 1½ minutes and had a temperature of 70 degrees. By continuing the mix for two minutes the temperature was raised 5 to 10 degrees. A 2 per cent solution of calcium chloride was used in the mixture.

PLACING CONCRETE

The concrete when taken from the mixer was conveyed by a lift and cableway for a distance of 700 to 800 feet over the portions already completed to the rings being poured and protected as described above. Here the bucket was dumped at the proper elevation and chuted through the flap opening into the forms. The interval which elapsed from the time the concrete was taken from the mixer until it was placed in the forms was an average of 5 to 6 minutes. In this time the concrete lost about one degree of temperature when the air temperature was 32 degrees. The tarpaulin permitted only a small amount of daylight to filter through, so that it was necessary to provide gasoline lanterns for the use of the workmen.

HEATING FORMS

The forms were heated with salamanders and steam lines for 12 to 24 hours before the concrete was placed so that the form would be thoroughly warmed and the temperature at all parts would be at least 50 degrees Fahrenheit. The salamanders were used while the concrete was being placed, but as soon as the placing of the concrete was completed and the flaps sealed, live steam was turned into the forms and was continued for a period of 5 days, the temperature inside the forms being maintained at 50 degrees or more during that period.

The live steam pipes and salamanders were carried on the form work under the arch rings and the heat had free circulation inside the tarpaulin covers. The salamanders were fired with coke and these fires were permitted to go out soon after the concrete had been placed and the live steam turned on, as the steam alone furnished sufficient heat. The live steam was let into the forms through ¼-inch jets with a jet provided for each 2,000 cubic feet of air space. When pouring the sections of the arch rings near the lower end, canvas curtains were hung near the upper end of the section being poured in order to bulkhead the heat and prevent it rushing to the crown of the arch.

Test beams were made in connection with each pour and these test beams were cured under the tarpaulin and under the same conditions as the concrete placed in the forms. Test beams made at the time of pouring concrete on October 7, 1928, when cured 10 days without special protection showed a modulus of rupture of 379 pounds and the same concrete cured 14 days had a modulus of rupture of 426 pounds. Concrete which was poured later during cold weather and protected as above at the end of 10 days had a modulus of rupture of 448 pounds and at the end of 14 days had a modulus of rupture of 523 pounds. To date no ill effects are apparent in connection with the winter work. However, it will be some time before all the forms are removed and a complete inspection can be made of the concrete.

The pouring of the main arch rings was completed early in January and the work shut down for the winter, as it was not deemed worth while to continue the pouring of the deck work under winter conditions.

PERSONNEL

The construction is being carried out by the Concrete Steel Bridge Co., contractors, Clarksburg, W. Va., under H. P. Rule, as Superintendent. The work comes under the jurisdiction of the Clearfield Division of the Pennsylvania Department of Highways, S. W. Jackson, Division Engineer, and G. W. Philips, Assistant Engineer, who handled the inspection work on the job.

Practical Dredging

"THE massive boom swings slowly out. From it a mighty arm of steel and wood plunges into the depths to toss the water into flashing churning geysers and what may be likened to the giant's cupped hand at the end, disappears beneath the surface.

"There is a clanking of running chains—the whirr of spinning windlasses—a momentary pause—then a stiffening of cables and framework (much as though this Gargatuan slave were setting its muscles to the task) and slowly but irresistibly the arm swings forward. Then up, up, up—the barge careening to the effort—and out of the depths rises the great scoop, filled high with what it has found there below.

"Thus, the Dredge goes to work."

This quotation is from the foreword of "Practical Dredging," a little booklet by J. Werden Clark, Dredging Specialist, 17 Battery Place, New York City. The subject of dredging is ordinarily associated with cold, hard facts, highly technical details and uninteresting calculations. But in this book Mr. Clark has managed to add to the facts and authoritative advice on the subject of dredging, some of the romance and thrill and excitement of the profession, making the book fascinating as well as profitable reading.

The author begins with a very brief sketch of the history of dredging, touching only the high spots in its development and describing the quaint and what seems to us now decidedly ungainly methods of dredging in the sixteenth and seventeenth centuries.

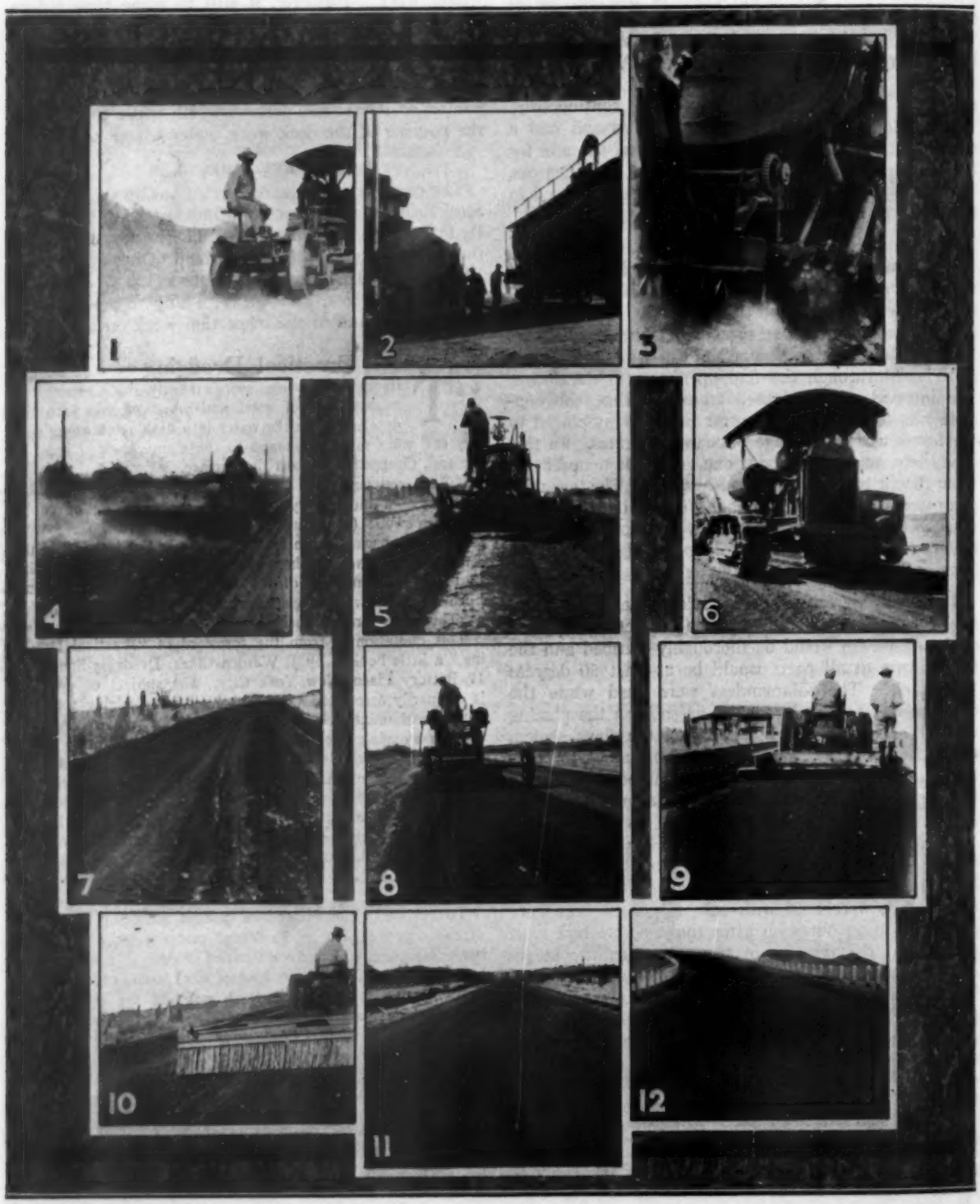
The various types of modern dredges, including the bucket dredge, dipper dredge, ladder dredge, pump or hydraulic dredge, bar or hopper dredge and combination dredge, are next described briefly with mention of the kind of work each is best adapted to. The creation of valuable land by filling, the improvement of reclamation of farm land from swamps and marshes, the improvement of estates and landscape gardening, sanitation and mosquito prevention are touched upon and illustrated by concrete examples where dredging has made this possible.

The final point emphasized by Mr. Clark is the necessity of accurate investigation of conditions and a thorough survey of the ground before beginning the job. So often thousands of dollars is needlessly expended because expert advice has not been secured before undertaking the actual work. The geological formation of the land, the right type of dredge, crews, method of procedure and so forth are all points on which a dredging specialist can give advice which will prove not only profitable in the actual procedure but may be of assistance in securing the contract.

A copy of this little booklet may be secured gratis by writing to Mr. Clark.

Oil Mix Highway Construction in Arizona

A Pictorial Story of New Method of Secondary Highway Construction



1. Scarifying the old road. 2. Loading the oil distributor. 3. Spreading the oil on the road. 4. Harrowing or "blotting" the oiled surface. 5. Mixing the oiled top with a heavy grader. 6. Laying down the surface with a tractor drawn grader. 7. The rough finish surface. 8. Finish blading with a light grader. 9. Dragging the surface to smooth the top. 10. Brooming the surface. 11. and 12. The finished road ironed out by traffic. Photographs furnished through the courtesy of W. W. Lane, State Highway Engineer of Arizona

Good Runways and Drainage at Rochester Airport

By Edwin A. Miller

Supervisor of Maintenance, Department of Public Works, Rochester, New York

WHEN the Rochester Municipal Airport, formerly Britton Field, was opened on June 1, 1928, there was much rejoicing at the culmination of a job well done. It brought much satisfaction to those men who were responsible for getting the field in readiness for the landing of the first air mail plane, in so short a time.

The site of the present Rochester Municipal Airport was acquired by the City in 1918 for $50,000. In 1927, after Lindbergh's flight, the indications were that aviation would develop rapidly, so rules and regulations were established by the Department of Public Works covering the operations at the flying field. Before the end of that year a contract for a hangar to cost $20,400 was awarded and work started.

In the spring of 1928, the U. S. Post Office Department advertised for bids to carry mail from Buffalo to New York, and the contract was subsequently awarded to Colonial Western Airways. This action necessitated improvements to the Rochester field to satisfy the Department as well as the air mail contractor, if this city were to remain on this route. Shortly before May 1, the Rochester City Council therefore appropriated $100,000 for this purpose, with the distinct understanding that the field must be in condition by the first day of June ready to receive the first mail plane scheduled to arrive on that day. With this sum available construction began at once.

The General Plan

The field is located 4 miles southwest of the center of the city on a short private road leading from Scottsville Road, a state highway on the direct route to Buffalo. It consists of a rectangular plot of ground 1,800 by 2,653 feet, containing 110 acres. With a gently rolling terrain and a maximum difference in elevation of 9 to 10 feet, a natural slope is provided.

On this rectangular area it was decided, after a study of local prevailing winds, to construct three runways arranged somewhat like the letter "A." Records of the U. S. Weather Bureau disclosed that for an average of 24 per cent of the period from May to October in each year, the wind was from the southwest; for 22 per cent from the west; for 16 per cent from the northwest, and for varying lesser portions of the time from the other directions of the compass, as indicated by the "wind rose" on the accompanying map. The arrangement selected provided for runway A running west-southwest and runway C running west-northwest in the mean directions of the prevailing winds, together with a secondary runway D running north and south. Runway B, proposed in the original plan, will probably never be constructed.

Runway A, the principal one, was originally to be 1,500 feet long by 200 feet wide, runway C 1,300 by 100 feet, and runway D 1,000 by 100 feet. All were to be constructed of a 6-inch base course of waterbound macadam with a 4-inch cinder top.

In addition to these runways it was necessary to construct a bituminous roadway 1,100 feet in length by 20 feet in width from the entrance to the field on the Scottsville (Buffalo) Road and leading up to the hangar and proposed runways.

While the landing field plan was still under discussion, the hangar was about completed, this work having been contracted for in the fall of 1927.

Construction of Runways

The most important question asked by officials interested in airport construction is "Runways or not?" If runways, how shall we build them? In the September issue of *Airports*, published in Flushing, L. I., there are discussions on the value of the different types of runways, including asphalt, concrete, turf and others. But the answer is to be found in the solution of the individual drainage problem. The all-turf landing field adapts itself better to natural drainage, and the heavier the soil the greater the need for runways unless elaborate drainage systems are provided. Some desirable and undesirable features exist in each type.

"Turf is the best but most expensive. Cinders have a cushioning effect in landing but slow up take-offs. They are also destructive to wings and propellers. Cinders have low visibility at night and are more difficult to light and maintain. Slag is picked up by the propeller and injures both it and wings. Asphalt becomes soft in hot weather and is subject to being scarred by tail skids. It also becomes very slippery in winter when wet or ice covered. Concrete is hard on landing gear and tail skids. Concrete offers its best advantage in take-offs with heavy loads." Such are the comments heard. Needless to say, they all have their good and bad points.

In Rochester we had to adopt the runway system. Our choice of construction was a combination of two types: stone base for easier take-offs and cinder top for a cushioning effect in landing.

Work was started on the runways on May 9, and by June 1, 10,000 cubic yards of excavation had been made for runways and trenches. Some 17,000 tons of stone had also been placed covering an area of about 40,000 square yards. In addition, other incidental work had been done. Four Keystone gasoline shovels were employed in making the 6-inch cut for the runways, and 30 to 35 teams and wagons used to haul the excavated material to the southeast corner of the field, where it

was dumped and graded for an auto parking space.

Stone was purchased by contract, delivered at the airport. The base course, consisting of No. 4 stone, was dumped from trucks approximately where needed and spread by means of a road grader, a bull-dozer, and by hand. It was then thoroughly rolled, three 10-ton rollers being used for the purpose, after which limestone dust was applied. When dry, this was distributed by means of a mechanical chip spreader. During wet weather, however, it was found advantageous to provide a stockpile, to use a crane and 1-ton Ford trucks for applying both dust and the cinder top course. No problem was encountered with the cinder top of the runways other than the difficulty of obtaining locally the immense quantities needed.

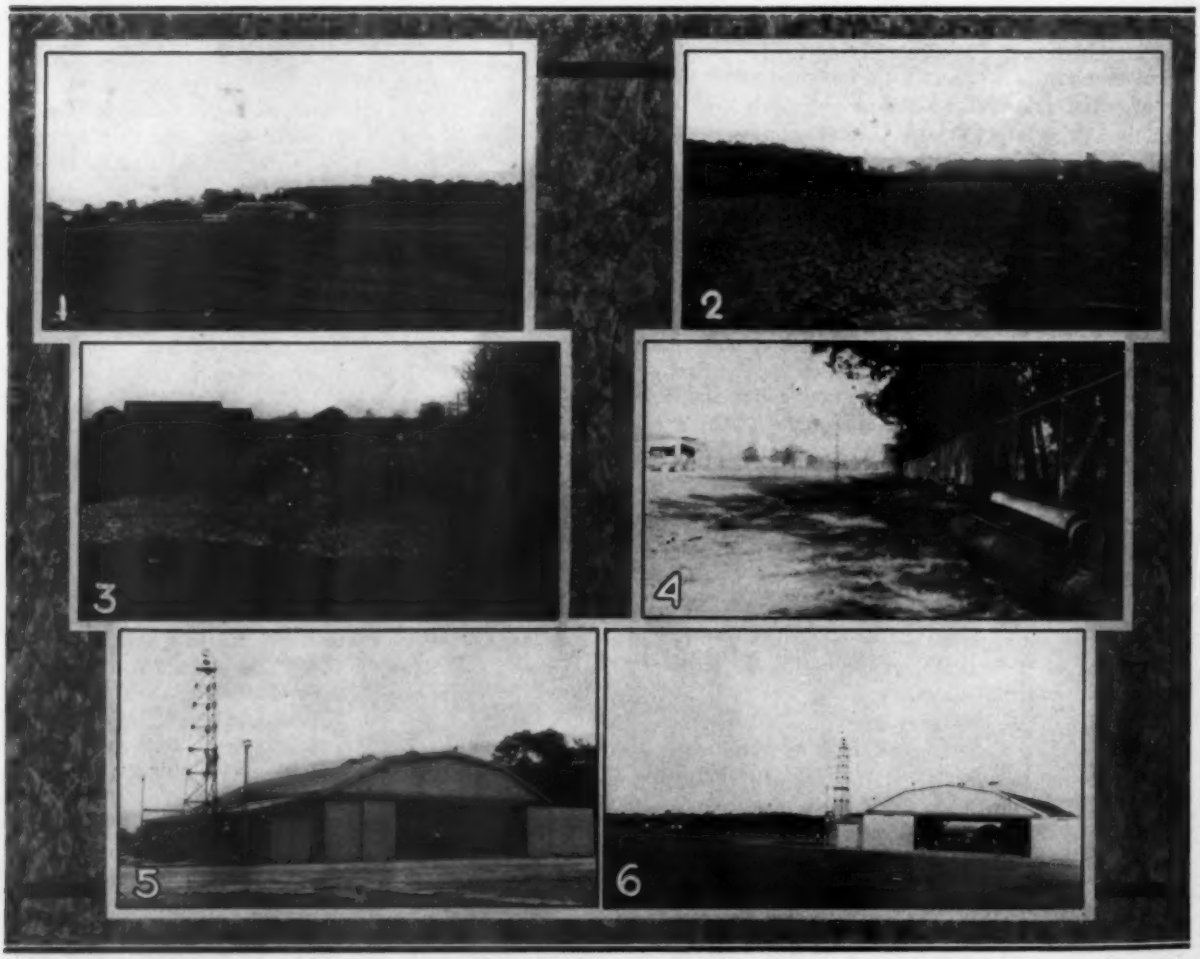
Runway A, the principal runway, was first completed and then runway C. As the need for runway D was less urgent, it was not included in the original construction, but was constructed later with the regular maintenance force. Between May 9 and June 1, the period of most intensive construction, the work was aided by almost perfect weather. As high as 150 men were engaged daily in the operations under way.

DRAINAGE

The necessity for artificial drainage was appreciated from the start, due to waterlogging of the surface near the proposed flying center of the field. With ample difference in elevation to provide adequate fall, and with four possible drainage outlets, it was decided to install an all-year drainage system that would offset the tight soil encountered and provide protection for the runways. This system called for drains along the runways, the taxiway in front of the hangar, and along the private roadway, making a total of 7,500 lineal feet.

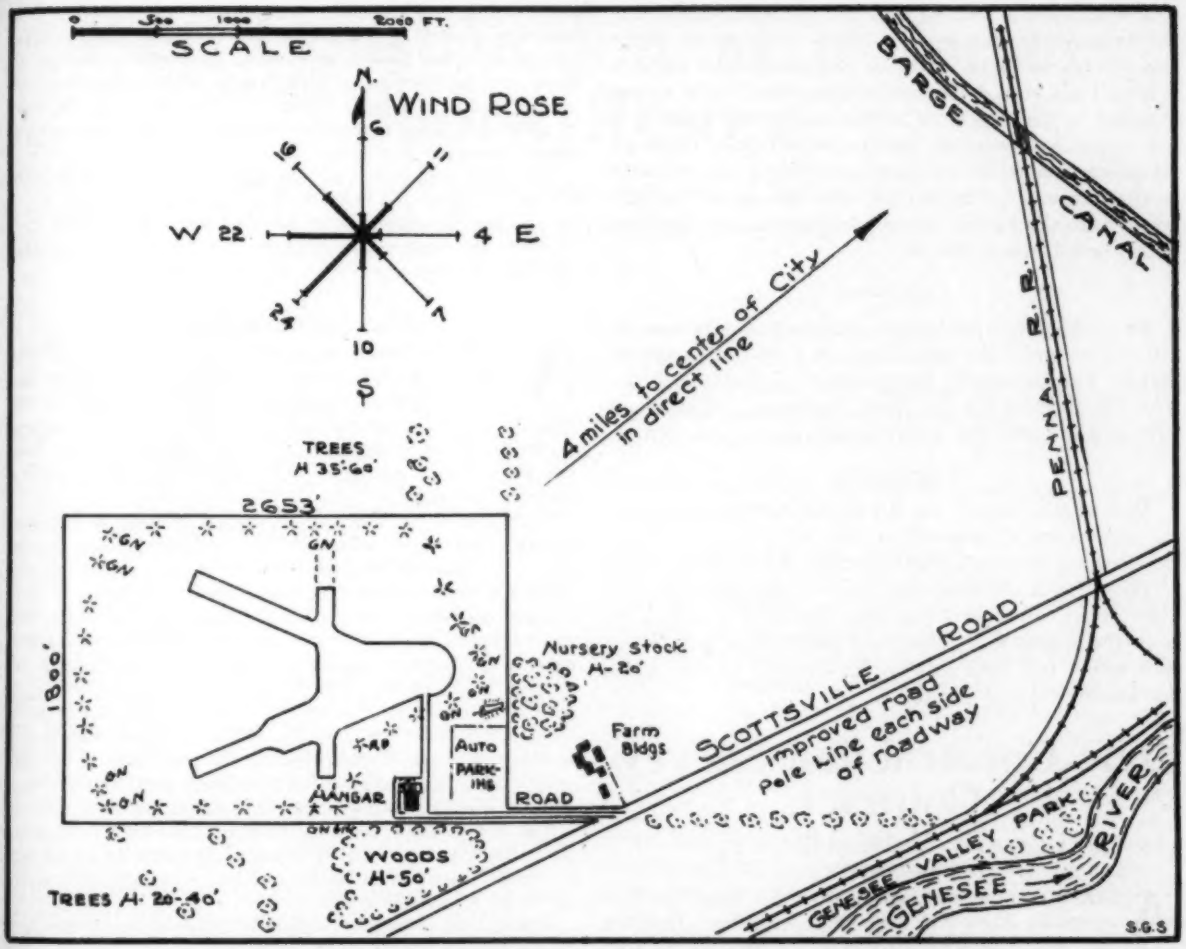
At the outset, it was planned to use 6-inch octagonal farm tile, 8-inch open joint vitrified tile, and 8- and 12-inch Armco perforated iron pipe. The last-named appeared to be particularly well adapted to airport drainage, because of the speed and economy in laying and its ability to withstand the impact which is encountered in landing planes, or from truck wheels during construction work. To increase the collection capacity of all drains, trenches were backfilled with gravel and crushed stone.

It was found that, due to the need for wrapping the tile joints with burlap, coupled with inspection and de-



CONSTRUCTION SCENES AND THE COMPLETED MUNICIPAL AIRPORT AT ROCHESTER, N. Y.

1. A view across the landing field toward the hangar. 2. The base course of the runway in place ready for the limestone dust and cinder top. 3. The bituminous macadam driveway under construction from the main state highway to the hangar. 4. Perforated iron drain pipe awaiting installation in the drainage trenches. 5. Close-up of the hangar and lean-to. Note air beacon and floodlight. 6. Easily accessible full width doors at both ends enable the hangar to easily accommodate large planes



MAP SHOWING ROCHESTER AIRPORT AND ADJACENT TERRITORY

lay in culling out broken sections of tile, and the care necessary in placing stone around the tile, the cost of tile per foot-in-place was more than that of Armco perforated pipe. This fact, together with the failure of one line of tile to function properly after it was installed, and the speed with which the longer sections of perforated iron pipe could be installed, led to the use of the latter type of drain for subsequent construction even where impact was not a serious factor.

Trenches for the drains were excavated with a Barber-Greene excavator while the runways were being constructed. Instead of being located directly along the edge of the runways, they paralleled the runways, at a distance of about 4 to 10 feet. This was done to prevent silting up of the crushed stone backfill with washings from the runways, and proved to be a valuable expedient.

In backfilling the trenches with stone, the finest material was placed next to the pipe, and the coarsest on the top. To prevent disjointing or breaking the lines of tile, stone was dumped alongside the trenches or on baffle boards in the trenches and then placed around the tile by hand. Where Armco perforated pipe drains were used, trucks dumped the stone directly on the pipe and the economy obtained by that method is readily apparent.

The effectiveness of the drainage system as a whole is indicated by the fact that notwithstanding the unusually rainy summer which set in shortly after the system was completed, the field has been kept in excellent operating condition at all times.

BUILDINGS

Buildings constructed to date include a hangar, 100 by 80 feet, with a lean-to 100 by 20 feet, and a pump and transformer house. The hangar is of steel frame construction, with walls of cinder block, doors and roof of wood, and floor of concrete. The windows are the steel-sash type affording a maximum of natural lighting and ventilation. With a vertical clearance of 16 feet and a full-width door opening on both ends, the hangar accommodates large planes easily. The lean-to is given over to a repair shop, stock room, and an office.

The name of the city is painted on the roof of the hangar, in large white letters on a black background.

EQUIPMENT

At the present time, the most important items of lighting equipment are an 8,000,000 candle-power rotating beacon, located on a 50-foot structural steel tower near the hangar and on clear nights visible for thirty miles, and approximately 40 boundary, obstruction, and approach lights, together with the various floodlights illuminating the hangar.

A wind cone is located near the eastern boundary of the field where it is readily visible from every direction. Plans are being made to illuminate it at night.

A well has been drilled and a pneumatic water system installed in the hangar. First-aid equipment, foam type fire apparatus, weather instruments, repair facilities, telephone, and other required equipment are installed in the hangar. A "fueling pit" has also been installed adjacent to the hangar, where airplanes may be serviced with gas, oil, water and air.

PERSONNEL

All work except the hangar construction was done by city forces under the general supervision of Harold W. Baker, Commissioner, Department of Public Works. The construction of the roads, runways and drainage system was under the direct supervision of the writer.

CONCLUSION

As it stands today, the Rochester Airport represents an investment of about $184,000. Of this amount approximately $114,000 was expended during May, 1928.

Thus, for a nominal sum and in the short time of thirty days, an airport has been provided which meets with the approval of pilots and government authorities and which will take care of Rochester's airway needs for several years to come.

The Construction Survey Contract

By G. Szmak,
Economist

A GOOD deal has been said and written about the irresponsible buyer and seller of construction. This fact not only indicates a problem but also the urgent need of a solution. While it is impossible to eliminate entirely unfair practices, yet it is very easy to increase fairness by encouragement. Catch phrases, slogans and cooperative movements to improve ethics, however, do not increase fairness while inefficient or degenerated methods of transacting business remain in use.

Through research in the field of contracting better methods are continually being developed to improve the equity between buyer and seller. This advance is made by utilizing the merits and scrapping the demerits of the present forms of contract.

Although used extensively, it is continually proven by fact that lump sum contracts do not protect either buyer or seller. Which one gains or loses is a matter of more or less conscience as the information upon which lump sum contracts are usually based is not sufficiently positive to afford full protection. Thus extras are the rule rather than the exception under this form of contract.

The cost plus contract is another form that has been used by some of the larger buyers of construction. This method has at least one distinct advantage. It eliminates the entire risk of the seller while the buyer assumes payment for all material and labor required to erect the structure plus a definite percentage fee for contractor's management and profit. The seller's risk having been eliminated, the contractor is free to concentrate upon producing a good piece of work. Unfortunately, or otherwise, not every buyer is willing or can afford to pay for construction at an indefinite price.

A third and more recent form is the construction survey contract which is universal for the reason that it eliminates the risk of both buyer and seller. This form of contract is based upon a construction survey which reveals in advance the exact quantity, quality and price of each part of the structure so that the entire transaction is open for examination at all times. Under this method the buyer is enabled to know precisely the cost of each item in advance, compare the cost of a certain item by different bidders and also the cost of one item against another to determine the most economical construction that is suitable.

The total actual cost of the project is determined more positively under this method than any other because every survey contract is supported by a preliminary estimate prepared by the construction surveyor as well as by the contractors' final estimates.

The Lamella Roof

A THIRTY-PAGE illustrated booklet entitled "The Lamella Roof," which is one of a series "Lumber and Its Utilization," has recently been published by the National Lumber Manufacturers Association. This handbook covers the standard practices in the erection of trussless roof structures and is prepared for the information of architects, engineers and builders.

It is pointed out that due to the organization of industry in larger units, mass production, and the growing use of conveyors in manufacturing assembly, there is an increasing demand for large unobstructed floor areas in all kinds of commercial structures and a similar demand for buildings with roofs supported only by walls in such fields as warehouses, garages, auditoriums, gymnasiums, skating rinks, armories, recreation halls, airplane hangars, and large barns. The use of lamella trussless roof construction in the building of the giant temporary hall for the 1928 Democratic National Convention in Houston, Texas, brought the lamella idea, already successfully used in many parts of this country, into popular favor and has resulted in much lamella construction.

The new booklet traces the origin of the design, illustrates its methods and principal advantages, discusses its application to certain classes of buildings, and lists structures in America which have used the design.

The lamella roof had its origin in Germany, being invented shortly after the great Tokio earthquake in 1923, by a German engineer who sought to devise a type of construction which would withstand the devastating effects of earth shocks. The design has had wide application in Germany. It was first introduced into this country in 1925, when American patents were taken on it and a syndicate formed to grant licenses for its use. The wind resisting characteristics of the type received a severe test in 1926 and 1928 Florida hurricanes. The buildings exposed were found to have weathered the storms unusually well.

The lamella design makes use of two simple engineering devices; namely, the arch and the net work. The roof is made of relatively short wood members called lamellas, varying from 2 inches x 8 inches to 3 inches x 16 inches and in length from 8 to 14 feet. These pieces are bolted together forming a network of framing lumber completely covering the building in arch form. This network is not unlike that of diamond mesh expanded metal lath, except on a much larger scale. The thrust of the arch is taken up either by steel tie-rods extending from side to side of the building, by buttresses, or bents with diagonal struts so placed as to take the thrust. The use of the buttress or bent system is usually a little more expensive than the simple tie rod system but allows for a clear expanse from roof to floor.

The handbook also points out its fire retardant qualities as, of the several hundred lamella roofed buildings in this country, only one is reported to have experienced a fire. The high arch and the elimination of supporting members protects a lamella roof from damage by fire.

Copies of "The Lamella Roof" are available gratis to persons addressing the National Lumber Manufacturers Assn., 702 Transportation Bldg., Washington, D. C., and mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Pier Construction at a Jersey Shore Resort

James Ferry Company, Inc., of Atlantic City Builds Casino Pier Substructure At Asbury Park, N. J.

IN the construction of the substructure for the new Casino at Asbury Park, N. J., by the James Ferry Co., Inc., of Atlantic City, a type of pier construction, new to that vicinity, was used. The deck is carried by 70 columns of various sizes, encased with cast iron pipe, ranging from 30 to 54 inches in diameter. These columns are resting on round concrete footings supported by wood piles.

Lackawanna steel sheet piles, 26 feet in length, were driven to conform with the diameter of the footings. The necessary excavation inside the sheet piles was done by an injector, which was operated by compressed air and water under high pressure. The wood piles were started down with a jet and were driven to 15 feet under water with two 9B2 McKiernan-Terry hammers operated by compressed air.

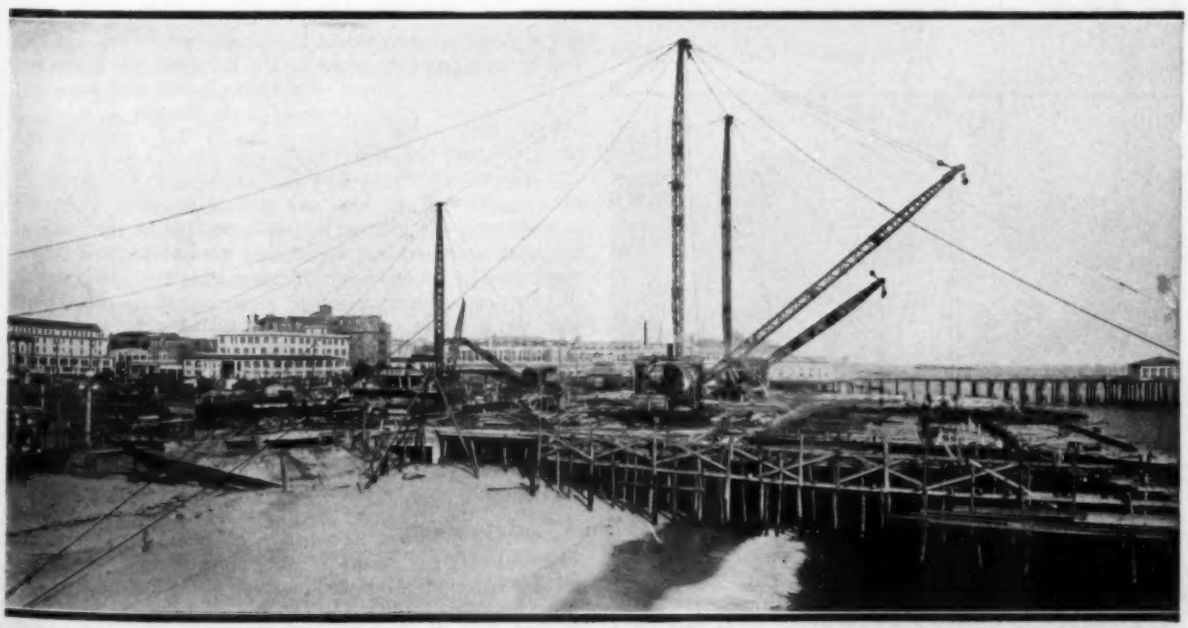
The concrete for the footings and columns was poured by using a 1½-yard tremie, 18 inches in diameter by 25 feet long. The cast iron pipe was carried from 3 feet below low water to the underside of the deck beams to act as a protection to the columns against ice and floating debris hitting them. A No. 6 McKiernan-Terry hammer with inverted attachment was used to pull the steel sheet piling.

Temporary wood piles, together with a few existing wood piles from the old Casino building, were used as false work for the deck slab.

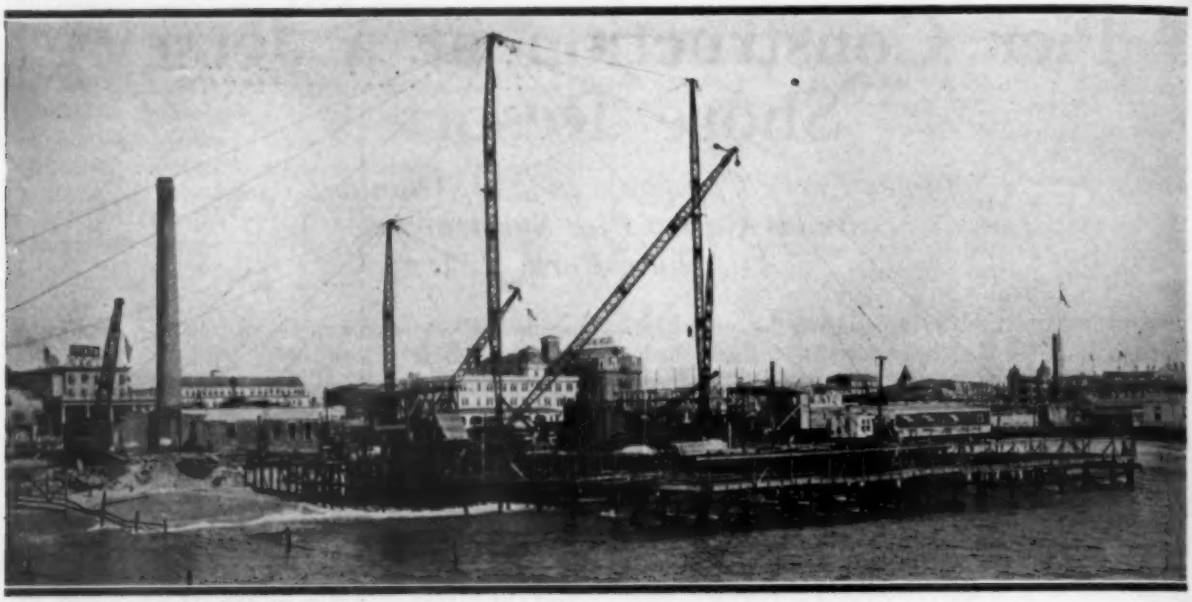
Construction Plant Simple But Complete for Pier Work

The construction plant consisted of three guy derricks, two of which were set on the deck and the third along the boardwalk which fed the other two derricks. The three derricks handled all work outside the boardwalk. A Ransome 27-E paving mixer and 5 or 6 hired batch trucks made up the concrete plant. Concrete was poured by using one-yard bottom-dump buckets handled by the guy derricks. Two gasoline cranes were used for the portion of the building inside the boardwalk. Two 8 x 6 and one 10 x 8 Ingersoll-Rand and one Pennsylvania air compressor furnished compressed air for the injector and air machines. A 6-inch Lecourtenay centrifugal pump was used to furnish water for jetting, developing 175 pounds pressure per square inch for this work.

Extra precautions were used in selecting a finely ground cement for this job. Lehigh cement, 90.6 per cent of which passed a 200-mesh screen, was specified. All exposed surfaces are waterproofed, to prevent salt



Setting Structural Steel with Guy Derricks. Concrete Was Poured with the Derricks and Bottom-Dump Buckets



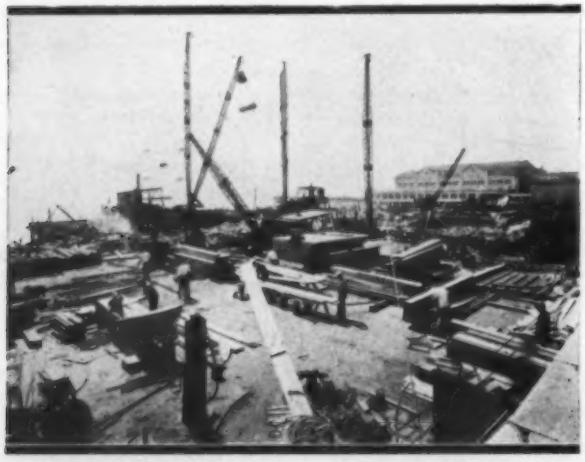
Derricks with 100-Foot Booms Reached All Parts of the Deck to Handle All Material

air from attacking the reinforcing steel and causing spalling of the concrete.

HANDLING GROUND WATER BY WELL-POINT DRAINAGE

One of the main problems on this job was lowering the ground water level 10 feet below high water in order to construct a sea wall on the outer side of the boardwalk. This was done by using three 6- x 12-inch Goulds Pyramid pumps and well-point drainage, which operated very successfully.

Warren & Wetmore are the architects on this building, H. G. Balcom is consulting engineer, and De Riso Bros., Inc., the general contractor. The James Ferry Co., Inc., Atlantic City, N. J., has the contract for all concrete decking and foundation work.



Guy Derrick Handling a Load of Wooden Piles and Gas Cranes Excavating for the Sea Wall to 15 Feet Below High Water. Lumber Storage in Foreground

Educate for Safety

REMEMBER that workmen must be educated to think and work for accident prevention. Unless that idea is sold to every man on the job, one moment of carelessness on some one's part may mean a lifetime of regret.

The Step by Step Method of Erecting Guy Derricks

LOCATING and placing the anchor slings of plow steel wire constitutes the first step in erecting a guy derrick. The slings should be buried 6 to 8 feet in the concrete of the foundation and should project about 3 feet above the finished top. Six to eight slings are required for the actual guying and two others for use in erecting and raising the derrick. One of the latter is used as an anchorage when lifting the boom during erection. The other is placed close to the mast and used for a lashing that will prevent the boom from sliding ahead when it is raised for the first time.

The hoist, usually a 100-horsepower electric machine with a line pull of 9,000 pounds and a drum speed of 350 revolutions per minute, may be placed either in the basement or at ground level outside the building.

The boom sections should be bolted together on skid timbers running from the street to the basement, the heavy end of the boom being placed on a timber which rests on a mat of heavy planks at the proposed mast location.

The hoisting wire and sheave blocks that eventually will be used as the boom lift should next be stretched from the top of the boom. Then with the bottom of the boom lashed to the auxiliary anchor sling and with temporary guys attached to the boom, the hoisting wire is made fast to the drum of the hoist and the boom raised to a vertical position. When the inclination of the boom at the start is not very great, it will be found advantageous to place a vertical pole at the base of the boom over which the hoisting wire can be run; this makes the line pull more effective.

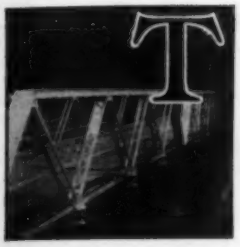
With the boom in a vertical position the falls can be used to assemble the mast and place the foot-block; and with the guys fastened to the mast it can then be raised to a vertical position and the guys attached to the anchor slings and equalized by turnbuckles.

As final operations, the boom is connected to the mast by a pin and the temporary guys used on the boom are tucked inside it for use when the derrick is raised. On an average, the erections of a guy derrick requires ten men three days.

This is a portion of the report of the Committee on Construction Plant and Methods for Steel Buildings which was published in the March, 1929, *Proceedings* of the American Society of Civil Engineers, pages 657-662.

A Study of Protective Coatings for Structural Steel Bridges

Various Priming and Finishing Coats Compared As to Action in Inhibiting Rust and Life of Paint



THERE is perhaps no place in structural steel work where the question of paint is of so much importance as on bridges. Without the protection offered by paint, no bridge could long be safe for the traffic it carries. The final failure and condemnation of most bridges is primarily due to the corrosion of some of the important key members. Chemists and engineers constantly have been investigating and experimenting with different types of coatings for bridges that will protect them against the elements and give them longer life.

The essential qualities of a protective coating are: 1, it should be waterproof to a high degree since moisture conditions over rivers, bays and swamps are more severe than in other structural steel work; 2, it should inhibit corrosion, effectively stopping any rusting that is already present when the steel is coated; 3, it should be of such nature as to be applied easily and economically; 4, it should give semi-permanent protection to the steel for a long period without maintenance cost; 5, its color and final effect should be such as to enhance the beauty of the structure and to meet with the artistic standards of the best architectural practice.

Various Protective Coatings

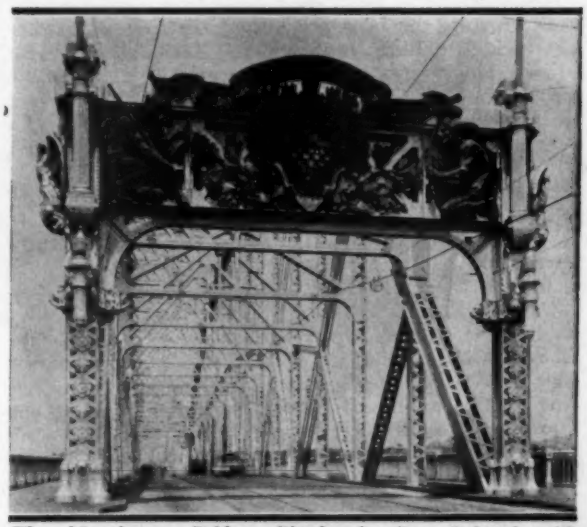
The usual method of protecting a bridge against corrosion has been that of painting. Guniting with a cement gun and spraying metal coatings have not come into general use, while galvanizing has proved too expensive and impractical. A common practice has been to use a priming coat of red lead in raw linseed oil, followed by top coats of white lead in oil colored with lamp black or various other pigments. This method is expensive, so asphalt and pitch paints are often substituted to lower the cost. Neither is very durable. The lead top coats either chalk away or become so brittle as to crack and peel while the pitch paints usually fail within a year or two. In recent years, research workers have turned their attention toward the problem attacking it from the priming coat angle.

Priming Coats

Through research by various paint companies in cooperation with bridge engineers and the American Society of Testing Materials, there has been developed iron oxides and chromate types of paints. The good "red oxide" has the property of making not only a hard drying and close drying film, but also a film that is fairly durable and not too expensive. Consequently, much of the steel furnished for bridges today is primed with red oxide. A better primer, however, and one whose cost is not excessive, is one containing basic chromates as a portion of the pigment. Chromates have the very useful property of stopping or inhibiting the rusting of steel and iron. If a steel surface is not very carefully cleaned there is always present a certain amount of iron oxide either as mill scale or rust. The rust in itself is an exciter of more rust and unless this action is stopped, the corrosion will soon go so deep as to impair seriously the strength of the member. By the use of inhibitive pigments, such as chromates, this action is considerably retarded and greater life is added to the top coats of paint. Good red lead also has this inhibitive action and is a standard high grade priming paint, but its high cost and low covering capacity have limited its use. Also, too often the so-called "red lead paint" is an adulterated cheapened product of questionable durability.

Finishing Coats

The paints most frequently used for finishing coats consist of white lead in oils with various combinations of black iron oxide and red iron oxide, zinc oxide, carbon black, chrome green, prussian blue and burnt amber or other tinting pigments. In addition flake graphite combined with silicious matter or red lead or unadulterated graphite have had considerable use. Sublimed blue lead also has been used with some success both as a primer and a finishing coat and tests have shown it to be of good durability.



The Manchester Bridge, Pittsburgh, Pa., Painted with Aluminum Paint During May, June and July, 1928

With the development of aluminum paint a strong competitor of the older industrial paints has entered the bridge paint field. It has most of the advantages of the other paints and few of the disadvantages. It is very durable, has high waterproofing qualities, resists corrosive actions, has good hiding power, is not unduly expensive and is attractive.

EXPERIENCE WITH ALUMINUM PAINT AT MASSENA, N. Y.

In 1923, the Borough of Massena, N. Y., became interested in painting a two-span bridge over the Grasse River with aluminum paint. The bridge was primed with red lead, followed by two coats of aluminum paint, made with two pounds of aluminum powder to a gallon of vehicle which was an air-blown linseed oil diluted with mineral spirits. There were 975 tons of exposed steel on the bridge and the aluminum paint gave a covering of 3½ tons to the gallon. A recent inspection of the bridge has shown that after six years the paint is in excellent condition and repainting will not be necessary for a number of years to come.

Later tests by the Research Bureau of the Aluminum Co. of America showed that the air-blown linseed oil vehicle, while being exceedingly economical, is not as durable as other types of oil and varnish. The tests indicated that a vehicle of spar varnish not only would have longer life, but would give a much brighter appearing surface and better brushing qualities. In 1924 Allegheny County, Pa., changed its specifications for the finishing coat on the Washington Crossing bridge at Pittsburgh from the battleship gray to aluminum. The Washington Crossing bridge is believed to be the first bridge on record as being painted with aluminum paint made according to modern standards. There are today about 300 aluminum painted bridges in the country, the first of them having been painted in 1923.

Handling Steel on Erection Jobs

IN handling steel from the street to the upper floors of steel buildings, it is desirable to take it directly from the truck. It should arrive in the trucks in piles of about 10 tons separated by means of 6 x 6-inch timber loading blocks, thus permitting the hoisting slings to be attached easily. The sling used in hoisting work is termed a bridle and consists of two slings of 1 or 1¼-inch steel wire joined by an eye which engages the hooks of the hoisting blocks. On the ends of each wire are eyes and loose pin screw shackles, the pins being removed and replaced each time a load is picked up. The use of two bridles is advantageous, as the ground men may be attaching one while the load is being hoisted.

It is common practice to hoist all columns first, followed by the spandrel beams and wind-bracing, and, finally, by the interior beams. An entire tier is hoisted before any erection is begun.

On the working floor, the steel should be sorted and placed in the panel over which it will be erected. The outside columns and wind-bracing are erected first. A corner panel is then erected and plumbed and interior erection continues from this point. Erection always progresses from the outside toward the derrick. As soon as one panel across the entire building is erected, wires are stretched to bring the structure into plumb. Transits are not necessary for this work, the results with a plumb-line being sufficiently accurate. Elevator constructors consider that shafts are satisfactory if they are not more than ¾-inch out of plumb.

Great importance attaches to the immediate riveting of the top floor of a tier, because: 1—riveting eliminates complete and rigid bolting of the working floor which supports the next tier of steel; 2—the temporary flooring, therefore, will not have to be disturbed by the riveters, who follow several floors below the erection assembly; and 3—a riveted floor gives the derrick additional stability.

Under ideal conditions the tile or concrete floor construction should follow steel erections closely, thus affording complete lateral stability of the structure at the earliest possible moment. In case this is not advisable the building should be braced temporarily by adjustable diagonal guy wires, extending from the top floor down two or more stories. In spite of this latter precaution it will often be noticed that the building weaves considerably when the boom falls away from the mast in order to hoist a load of steel from the street. This is an added reason why unusual care should be exercised in operating derricks on tall steel building frames.

This is a portion of the report of the Committee on Construction Plant and Methods for Steel Buildings which was published in the March, 1929, *Proceedings* of the American Society of Civil Engineers.

An Arc Welded Pile Driver

THE accompanying illustration shows an electrically arc welded pile driver, one of four made by the Mississippi Valley Structural Steel Co., Melrose Park, Ill., for the Walsh & Masterson Co., of Chicago. These machines have been subjected to very heavy duty, involving terrific vibration day and night for nine months and are now as rigid as when first built. Each pile driver is 85 feet high and operates a steam hammer weighing 10,300 pounds. At no sacrifice of strength a 15 per cent saving in material was effected in the construction of each. One of the principal advantages of the lighter weight thus secured is the greater ease with which these machines can be moved from place to place. With the exception of two guides for the hammer, made of special Carnegie steel, the material used is standard angles. A General Electric arc welding set was used in fabricating the pile drivers.

A Pile Driver 75 Feet High Completely Fabricated by Arc Welding by the Mississippi Valley Structural Steel Company, of Chicago, Ill.

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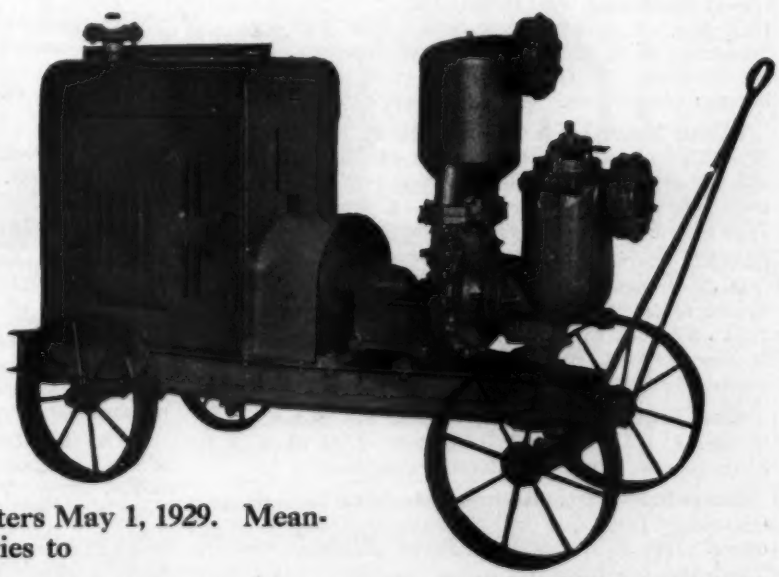

WE will be in our new quarters May 1, 1929. Meanwhile, address all inquiries to

THE LaBOUR COMPANY, Chicago Heights, Illinois

Who's Who in Construction

A Series of Reports from Active Contractors Published Monthly

BUS. VOL.—ANNUAL VOLUME OF CONTRACTS
A—Over $5,000,000
B—Between $1,000,000 and $5,000,000
C—Between $500,000 and $1,000,000
D—Between $250,000 and $500,000
E—Under $250,000

Siems & Carlson, Spokane, Wash., 412 Realty Bldg. Organized: 1922. Bus. vol. B. This company originated as a partnership in 1910 and worked as such until 1922, when it was incorporated. It is connected with Siems, Helmers & Schaffner, Inc., St. Paul, Minn. Although no permanent office is maintained in Alaska, this company does considerable work there. Officers: Claude H. Siems, Chairman; N. F. Helmers, Vice-President; Alfred Anderson, Vice-President; R. A. Schaffner, Secretary and Treasurer; A. L. Lowell, Asst. Secretary. Type of contracting: mainly railroad highway, hydro-electric, irrigation and drainage work. Some building.

N. F. Helmers

Claude H. Siems

R. A. Schaffner

Ferguson Bros. Co., Shinston, West Va., Pike St. Branch offices: Clarksburg and Dunbar, West Va. Organized: 1918. Bus. vol. C. Officers: H. S. Ferguson, President and Treasurer; F. M. Ferguson, Vice-President; F. E. Ferguson, Secretary. Type of contracting: grading, paving and highway construction.

William McCumber & Son, Chicago, Ill., 6540 So. State St. This company was organized by William McCumber about 40 years ago. Bus. vol. E. Officers: William McCumber, Charles W. McCumber, Theodore J. Franzen, partners. Type of contracting: general building work and alterations on residences, churches, stores, factories, etc.

L. C. Powers & Sons, Pineville, Ky., Kentucky Ave. Branch office: McCalla Ave., Knoxville, Tenn. Organized: 1920. Bus. vol. E. Officers: L. C. Powers, President; A. L. Powers, T. R. Powers. Type of contracting: general construction.

Shaw Bros., Toronto, Ont., Canada, 817 Federal Bldg. Organized: 1911. Bus. vol. B. Officers: T. H. Shaw, J. E. Shaw, owners. Type of contracting: building.

George B. Baer Co., Cleveland, Ohio, 10006 Carnegie Ave. Organized: 1905. Bus. vol. E. Officers: George B. Baer, owner. Type of contracting: building of homes.

Christensen Construction Co., San Francisco, Calif., 1755 San Bruno Ave. Organized: 1920. Bus. vol. D. Officers: C. B. Christensen, President; G. E. Brown, Secretary. Type of contracting: street and road work.

Goode Construction Co., Charlotte, N. C. Branch office: Winston-Salem, N. C. Organized: 1929. Officers: R. L. Goode, President and Treasurer; A. L. Goode, Secretary; F. L. Strawn, Engineer. Type of contracting: general.

Kalamazoo Construction Co., Kalamazoo, Mich., 117 Pratt Bldg. Organized: 1909. Bus. vol. E. Officers: J. H. Lowe, President and General Manager. Type of contracting: grading and paving.

H. E. Klefman Co., Cleveland, Ohio, 2844 Lorain Ave. Organized: 1915. Officers: H. E. Klefman, President; F. H. Klefman, Secretary and Treasurer. Type of contracting: libraries, commercial buildings, churches, etc.

Loesch & Green Construction Co., Cleveland, Ohio, 4169 Pearl St. Organized: 1925. Bus. vol. D. Officers: Edward H. Green, President; Howard H. Green, Secretary and Treasurer; Irving R. Lewis, Vice-President. Type of contracting: road paving and grading.

Kennedy & Halloran, Norwood, Ohio, Plaza Theater Bldg. Organized: 1927. Bus. vol. E. Officers: F. Kennedy, R. Halloran, partners. Type of contracting: general building of all kinds.

Flaugh-Logan Transfer Co., Meadville, Pa., 159 Pine St. Organized: 1920. Officers: C. P. Flaugh, President; A. J. Logan, Secretary and Treasurer. Type of contracting: concrete work and heavy hauling.

Leto Building Co., Detroit, Mich., 14250 Kercheval Ave. Organized: 1910. Bus. vol. D. This company was started in 1910, and was incorporated January 1, 1927. Officers: Gaetano Leto, President; Vito Leto, Vice-President; Peter Leto, Secretary and Treasurer. Type of contracting: apartments, gas stations, factories, stores and flats.

Wickham Construction Co., Cincinnati, Ohio, 707 Chamber of Commerce Bldg. Organized: 1921. Bus. vol. D. Officers: R. E. Biles, President; Charles W. Skinner, Vice-President and Consulting Engineer. Type of contracting: general.

Robert E. Tompkins, Rochester, N. Y., 97 Shelwood Road. Organized: 1924. Bus. vol. E. Officers: R. E. Tompkins, owner; W. F. Ashman, estimating engineer. Type of contracting: general.

Wallace E. Reid, Detroit, Mich., 13540 Linwood Ave. Organized: 1923. Bus. vol. E. Officers: Wallace E. Reid, owner. Type of contracting: general building.

Florida Drainage & Construction Co., Palatka, Fla., 209½ Lemon Street. Organized: 1913. Officers: J. W. Campbell, President; W. B. Hutt, Vice President and Superintendent. Type of contracting: drainage only.

G. A. Gustafson, Iron Mountain, Mich., 118-120 West B Street. Organized 1907. Bus. vol. E. Officers: G. A. Gustafson, owner. Type of contracting: building.

Rhodes & Manvel, Inc., New York, 90 West Street. Organized: 1902. Bus. vol. C. This company was organized in 1902 and incorporated under the laws of New Jersey in 1912. Officers: Herbert E. Manvel, President and Treasurer; John A. Devlin, Vice President; John G. Lewis, Secretary and Asst. Treasurer. Type of contracting: dock building, pile driving and concrete foundations.

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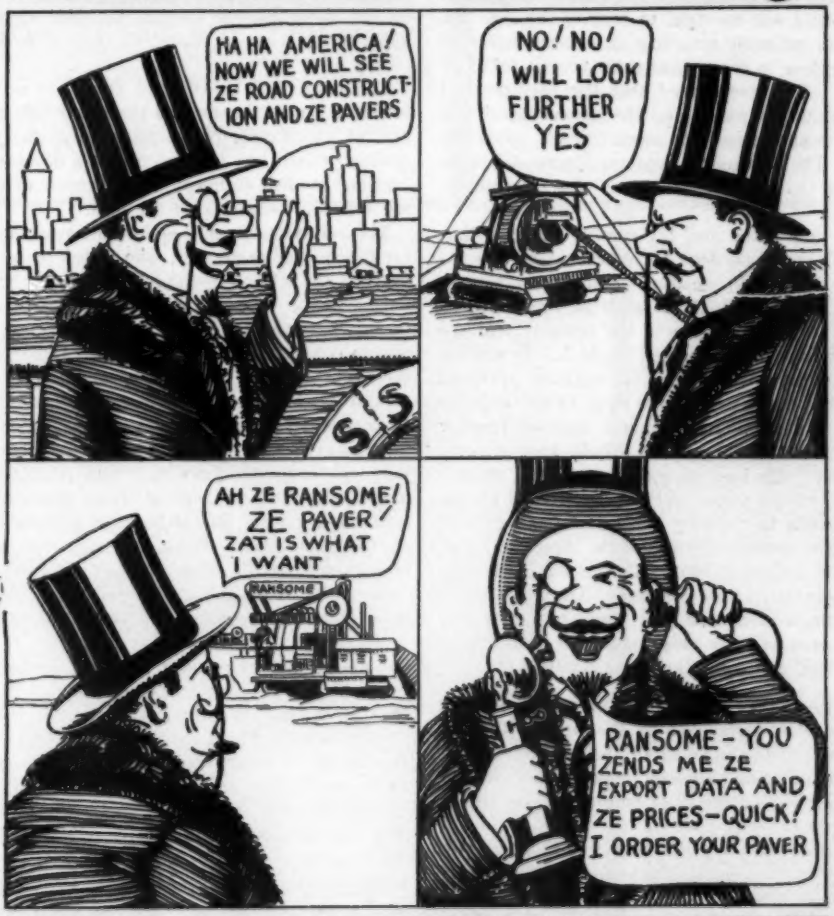
HA HA AMERICA! NOW WE WILL SEE ZE ROAD CONSTRUCTION AND ZE PAVERS
NO! NO! I WILL LOOK FURTHER YES
AH ZE RANSOME! ZE PAVER! ZAT IS WHAT I WANT
RANSOME
RANSOME-YOU ZENDS ME ZE EXPORT DATA AND ZE PRICES-QUICK! I ORDER YOUR PAVER

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PAVERS 27-E, 13-E, 10-E

Ransome Concrete Machinery Company

1909—Service for 72 Years—1919

Dunellen New Jersey

Legal Points for Contractors

These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney

Edited by A. L. H. Street, Attorney-at-Law

Proving Quantity of Work Done on Road Job

When a highway subcontractor brought suit against the general contractor and his surety for work done on a road, it was objected that there was no right to recover, because the contract provided for payment according to measurements of the work by the engineer in charge and there was no proof of such measurements. But it appeared that the engineer had failed to make such measurements, and the subcontractor was held to be entitled to offer substitute proof through exhibiting his force accounts. The Mississippi Supreme Court said in an opinion handed down October 8, 1928, in this case (Stowell vs. Clark, 118 So. 370):

"Appellants [the contractor and his surety] contend that the ascertainment of the work done by appellee [the subcontractor] in that manner was in violation of the contract. We do not think it was. Appellee did the work he contracted to do; and so far as the records shows to the contrary, did the work in the manner in which he agreed to do it. It was no fault of appellee that the contractor and the engineer in charge of the project failed to measure the work done by the appellee on a yardage basis. In view of that failure appellee foresaw that, in order to protect his rights, he should keep a force account, which he did. He kept an accurate account, according to the evidence, of the teams and employees, and all the implements used by him in carrying out his contract, as well as the time they were employed in the work. Appellee knew, as was shown by the evidence, that with this data his force account could be converted into yardage. The engineer in charge of the project testified that that could be done; that yardage and force account were interconvertible; that when you had one you could get the other by calculation."

Liability to Owner's Representatives on Premises

While a paving inspector employed by the city of Birmingham, Ala., was looking into a concrete mixer to determine whether materials were being properly prepared, his clothing was caught by lugs on a revolving shaft of the machine and he was seriously injured.

The opinion handed down by the Supreme Court of the state June 28, 1928, in the case of Mackintosh vs. Wells, 118 So. 276, deals with the liability of the contractor. The high spots of the opinion read as follows:

"If plaintiff was rightfully at or upon the machine by express or implied invitation, . . . the question presented is: Did defendant fail to exercise reasonable care in providing a reasonably safe place or machine at and with which plaintiff was to discharge his respective duties to the city on the one hand and the operating contractor on the other?

"The evidence is without conflict that the paving inspector, when injured, was in the discharge of his duty as an invitee, and as to him the contractor must have exercised and employed the reasonable care, skill, and means of an ordinarily prudent person so engaged—for the contemplated use and purpose of the express or implied invitation—as to avoid personal injury to such invitee."

The court found that the evidence was such that the jury could find that the accident was not due to contributory negligence on the part of the injured man.

Partnership Relations Between Contractors

An accounting of the affairs of a partnership that had been engaged in municipal contracting was involved in the opinion handed down by the Oregon Supreme Court November 13, 1928, in the case of Miller vs. Ashley & Rumelin, 271 Pac. 596.

The court had occasion to enunciate several rules of law having a general bearing on the rights and liabilities of members of contracting partnerships. But the principal concrete question raised was whether or not a deceased member of this firm had implied authority, as a member of the partnership, to sell warrants belonging to the firm.

The suit was brought against bankers who cashed warrants for the managing partner, who failed to account to the firm. Parts of the opinion of the Supreme Court read:

Miller, the deceased partner, "almost exclusively attended to the financial affairs of the partnership. The partnership was so conducted for several years. It was not necessary that direct authority be conferred by one partner upon the other to transact such business as is usually transacted by a commercial partnership. The fact that the business of a . . . partnership is conducted in a certain manner for a number of years is very convincing evidence that both parties acquiesced in, and assented to, that manner of doing business. If one partner transacts a certain line of business necessary to the promotion of the partnership affairs for a number of years, without objection from the other partner, we may conclude that the former was authorized by his partner to so transact the business. Long acquiescence will amount to ratification. . . .

"It is seriously argued that defendant is liable, because he did not inquire of plaintiff Bauer or formally get his consent to the transfer of that quantity of money from the partnership to said Miller. We do not think that is the law. By the established maner of transacting the affairs of said partnership, the decedent, Miller, must be held to have had authority to draw the money, and defendant is not responsible for what Miller did with that money under the evidence in this case. There is no showing that decedent Miller had no right to the fund. Unless notice of a misappropriation of the partnership funds by the decedent, Miller, was brought to defendent or such a state of facts as to put defendant upon inquiry, it cannot be held liable for funds of the partnership taken by one of the partners."

Formation of Contracts

Where, as is the case in most states, there is no statute requiring a private construction contract to be in writing and signed, a good and enforceable contract may be constituted through oral acceptance of a written proposal. This point was recognized by the Alabama Supreme Court in the case of Stephenson Brick Co. vs. Bessemer Engineering & Construction Co., 118 So. 570, decided November 8, 1928. But, of course, the terms of the proposal and the terms of the acceptance must coincide. So, it was held that if an offer to make certain excavation for a lump sum was treated as contemplating earth and shale excavation only, an acceptance on condition that a reasonable price should be paid for rock excavation fell short of constituting a contract.

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Work on the roads will soon begin. The time is at hand to order Road Machinery for spring delivery . . . only a few short weeks remain in which to put last year's equipment in order for another Season's service.

New roads, miles and miles of them, will be built this season . . . old roads must be maintained . . . put into shape for the summer. Work must soon start—don't delay—let us have your order . . . we can best take care of it now.

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A quick and economical job of one-man dirt road maintaining can be done with the Warco ten-ton Road Roller

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The Warco Screw Lift-

"Built Like a Screw Jack."

When Check Constitutes Final Settlement

It is frequently but incorrectly assumed that in all cases a creditor's acceptance of a check tendered in full settlement of an account or contract price is binding on him, where the check does not cover the full amount due him. The true rule of law is that acceptance of the check, so tendered in full settlement, closes the matter only where there is a bona fide dispute as to the amount actually due.

To illustrate, if an owner says to a contractor, "Here is a check for $5,000. You can take it or leave it, but it is offered to you in full settlement of what I owe you." The contract price was $6,000. The validity of this tender and the legal effect of the contractor's acceptance of the check depends altogether upon whether the owner makes some bona fide claim of right to make a deduction from the price. It is not necessary that his claim be a sound one legally, but it must be made in good faith. If he has no plausible excuse for not paying the full $6,000, the contractor can take the $5,000 check, cash it and make the owner "come through" with the other $1,000.

The theory of the law is that the tender and acceptance of a check is a contract that must be supported by some sort of consideration. So, if the owner owes $6,000 and has no plausible ground for disputing that fact, there is no consideration for surrender of the contractor's right to the full amount by acceptance of a check for part only. But if there is a dispute in good faith, the avoidance of litigation to settle that dispute is a good consideration supporting the contractor's acceptance of the check as final settlement.

In the case of Hanley Co. vs. American Cement Co., 143 Atl. 566, decided November 7, 1928, by the Supreme Court of Errors of Connecticut, it appeared that a bill for brick was $1,268. But the buyer had refused to accept part of the brick, claiming that they were not of the shade contracted for and asking what the seller wanted done with them.

The purchaser sent the seller corporation a check for $820 as full payment, that being the amount due, after deducting the price of the rejected brick. The check was cashed by the seller. But the seller sued to recover the balance of the bill. The trial judge held that there had been no such acceptance of the check as a final settlement of the account as to preclude recovery of the balance. However, the decision was reversed on appeal, the higher court holding that there was a binding settlement, and that it was no legal excuse for cashing the check that the seller's general manager was away on a vacation when the check came in and that it would have been rejected as a final settlement had he been on the job.

Wages of Idle Men as Element of Damage for Delayed Delivery of Materials

To the extent that a highway contractor suffered loss through idleness of employees caused by a third party failing to deliver gravel within an agreed time, the loss is a proper item of recovery against such third party for breach of his agreement, decided the Iowa Supreme Court in the case of Remsen Sand & Gravel Co. vs. Voiles Construction Co., 221 N. W., 502, decided October 23, 1928.

Contractor's Rights as to Extra Work

The case of Marshall Construction Co. vs. State of New York, 231 N. Y. Supp. 345, decided by the Court of Claims of New York November 9, 1928, specifically involved a highway paving contract. But much of the decision would apply with equal force to any construction contract involving excavation. The following is the substance of the decision on the major points of the case:

"Claimant cannot recover for the excavation of material outside the excavation lines, as shown on the plans."

When it appeared that the state engineer had made a mistake in staking out the road—the mistake being discovered after the work was done—and when the engineer directed the contractor to return to the place and follow other lines, involving further excavation into rock ledge, the contractor had the choice of refusing to proceed and recovering the reasonable value of work already done, or of continuing *under protest* and recovering the reasonable value of the extra work. In this connection, the opinion says:

"There is a dispute as to whether the contractor excavated to the lines as given it in the first instance, but I am convinced by the evidence and the surrounding circumstances that he [it, the company] did. The first cut, the grading, and the embankment were all done under the daily supervision of the engineer for the state, and he testifies that it was not up to him to call their attention to the fact that they were not taking it all out, and that his only duty there was to provide the grade stakes, and it was none of his business to see what they were doing after he set the stakes. He had, of course, no authority to direct the contractor how it should perform the contract or the order of performance, but it is incredible that he observed the contractor completing the grading and embankment for the full width of the road, and said nothing about its being 6 feet out of line. I think there was a mistake in giving the lines in the first instance."

That the extra work in such case be done under protest is essential to recovery of extra pay. "Such a condition is founded in justice and equity. The contractor is not permitted to acquiesce in the directions of the representative of the owner, and, after performing the work with seeming willingness, recover on the ground that the directions were erroneous. A protest calls the attention of the owner to a difference of opinion as to the requirements of the contract, and gives him the opportunity before the work is done to make a determination. He is not lulled into security by the seeming agreement of his contractor only to be aroused by a claim for damages which may arise solely as an afterthought."

Where, after old asphalt and concrete paving were removed, it was discovered that the old road had been sub-based with rocks and boulders, some a cubic yard in dimension, so that it was impossible to blast off or cut off the few inches necessary to bring the road to the grade fixed by the reconstruction contract, the contractor was entitled to recover for the work of entirely removing such rocks and boulders by direction of the state under a specification requiring the contractor to remove boulders, etc., as directed by the engineer.

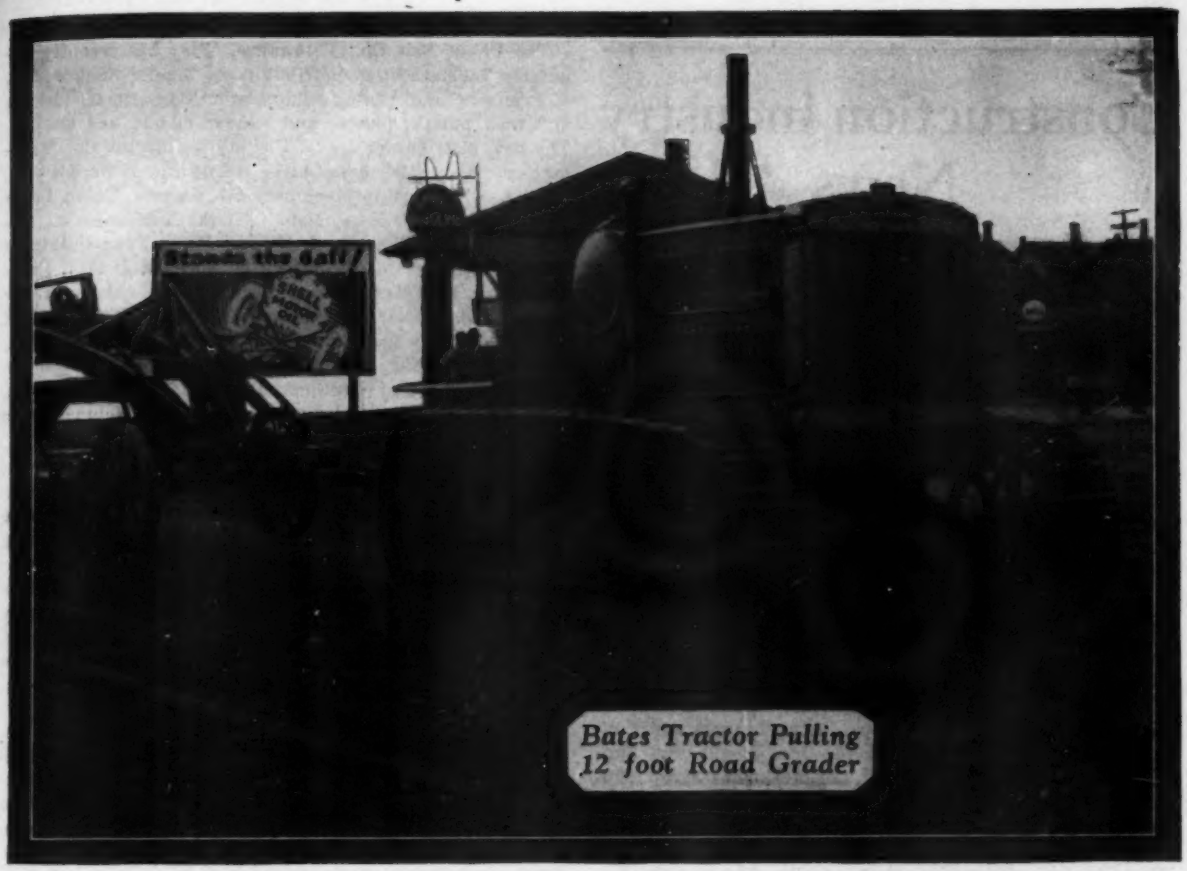
Subcontractors' Rights on Contractors' Bankruptcy

Priority rights given subcontractors in the matter of payment from the contract price are not divested by the bankruptcy of the general contractor, according to the decision handed down by the United States District Court for the District of Maryland, November 2, 1928, in the case of Mason-Curley-Brady, Inc., 28 F. (2) 981. The specific question presented for decision was this:

Where a contract for a municipal job provides for withholding by the municipality of payments to the contractor until it satisfactorily appears that all subcontractors and materialmen have been paid or secured, does this provision, on bankruptcy of the contractor, entitle a subcontractor to claim payment out of funds so retained by the municipality, to the exclusion of general creditors, or is the subcontractor merely entitled to share pro rata with the other creditors of the contractors

The court decided that the subcontractors have prior rights over general creditors, under such circumstances, saying:

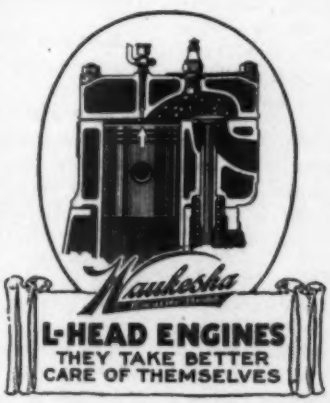
"Whatever rights a third party has against the property of the bankrupt before his adjudication, that party, in the absence of fraud or fixed liens created by state statutes in favor of others, has against his estate in bankruptcy; or, stated in the form that is more commonly used, the trustee is said to stand in the shoes of the bankrupt, and to have no better title than the bankrupt himself had at the time of the filing of the petition," etc.



TRACTOR PERFORMANCE

The design and motive power in tractors account for what they do. Go over their design and construction, part-by-part and you will find that a surprisingly large number of the best tractors are powered by Waukesha engines.

Study the cylinder and crankcase construction of these Waukesha engines. It will reveal many of the reasons for their unusually steady day-in-day-out performance. There is the broad-cheeked crankshaft with its over-size large diameter bearings -- efficiently lubricated with a full pressure oiling system. There is the patented girder type crankcase--the buried cylinder barrels and the patented Ricardo Head--a combination of features found only in Waukesha engines. A new standard of performance in power, long life and fuel economy is set by these engines.



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Construction Industry News

The Bates Valve Bag Corp., Chicago, Ill., has been purchased by the St. Regis Paper Co. The Bates Corp., originated and developed the Bates system of packing cement, lime, plaster, gypsum and other rock products with patented automatic machines and also a new type of valve bag. In 1924, the company became the principal manufacturer of multi-wall sewed end paper "valve bags" and also manufactures wire ties for cloth bags, retying machines and closing machines for open end bags. It is expected that the business will be carried on as a wholly owned subsidiary of the St. Regis Paper Co., under its original name.

The Butler Bin Co., Waukesha, Wis., manufacturers of steel storage bins, weighing and measuring hoppers, and bin gates have announced the appointment of the following new distributors: Arizona Road Machinery Co., Phoenix, Ariz., General Equipment Machinery Co., Miami, Fla., Hoffus-Ferris Equipment Co., Spokane, Wash., J. B. Harbison Equipment Co., Little Rock, Ark., Loggers and Contractors Equipment Co., Portland, Ore., Mechanical Supplies Co., Cincinnati, Ohio, W. T. McDonald & Co., Indianapolis, Ind., New Mexico Road Machinery Co., Albuquerque, N. M., Stannard-Arnold Co., Salt Lake City, Utah, J. C. Sheehan & Co., El Paso, Texas, Tri-State Equipment Co., Memphis, Tenn., Taylor Tractor Co., Columbus, Ohio, George V. Treen & Co., Charleston, W. Va., and Wiley Bros., Inc., Oklahoma City, Okla.

The Bucyrus-Erie Co., with head offices at South Milwaukee, Wis., and plants at South Milwaukee, Wis., Erie, Pa., and Evansville, Ind., has announced the removal of its Chicago district office to 105 West Adams Street, Room 1312, Bankers Building, where A. R. Hance will handle machines larger than 1¼ yards and W. K. Faweett will handle 1¼-yard machine and smaller.

The Construction Survey Co., Geza Szmak, Managing Engineer, 945 Main St., Bridgeport, Conn., has announced the expansion of its business offices to include New Haven and New York City. The New Haven office is at 185 Church St., and the New York City office at 122 East 42nd Street.

The Waukesha Motor Co., Waukesha, Wis., has announced the appointment of H. A. Huebotter to its technical staff. Mr. Huebotter was formerly Chief Engineer of the Butler Mfg. Co., Indianapolis, Ind. He is the author of a book "Mechanics of the Gasoline Engine."

Philip Carey Manufacturing Co., Cincinnati, Ohio, has announced that on December 12, 1928, all differences between its company and Servicised Products Corp., Chicago, Ill., were terminated, including the then pending litigation. As of that date, the Servicised Products Corp., was granted and is now manufacturing premoulded products under a license on patents owned by the Philip Carey Manufacturing Co., including in addition to patents formerly owned by that company, all patents heretofore owned by the Servicised Laboratories, Inc., relating to premoulded products, such as expansion joints, rail fillers, track pavements, railroad crossings, construction materials and other like products. Other than this arrangement, the two companies are entirely distinct and independent corporations.

The Chain Belt Co., Milwaukee, Wis., has recently appointed fourteen new distributors to handle its products, Rex mixers and pavers, diaphragm, centrifugal, plunger and road pumps, plaster and mortar mixers and sawrigs. The new distributors are G. C. Phillips Tractor Co., Birmingham, Ala.; McGowin-Lyons Hardware & Supply Co., Mobile, Ala.; Burnite Machinery Co., Denver, Colo.; Fuchs Equipment Co., Omaha, Nebr.; Gierke-Robinson Co., Davenport, Iowa; Sheehan & Co., El Paso, Texas; Arizona Road Machinery Co., (a branch of Sheehan & Co.), Phoenix, Ariz.; New Mexico Road Machinery Co. (also a branch of Sheehan & Co.), Albuquerque, N. M.; Youngstown Mill Supply Co., Youngstown, Ohio; LaLance Equipment Co., Huntington, West Va.; McNeilly Machinery Co., Columbus, Ohio; Earnest Brothers, Richmond, Va.; Clyde Co., New Orleans, La.; and Stannard-Arnold Machinery Co., Salt Lake City, Utah.

Hercules Motors Corp., Canton, Ohio, has recently completed a substantial addition to its plant as well as some extensive additions to its equipment. The new building and the equipment are now in full operation and the company is turning out between 2,500 and 3,000 engines monthly. In accordance with the Hercules policy that every engine be given a complete test equal to a laboratory test before it goes to the purchaser the testing equipment has been more than doubled.

The George D. Whitcomb Co., Rochelle, Ill., has announced that the Baldwin Locomotive Works, Philadelphia, Pa., one of the largest steam locomotive manufacturers in the world, has purchased a substantial interest in the business of the Whitcomb Co. The Baldwin Locomotive Works has made an arrangement with the George D. Whitcomb Co., to sell the Whitcomb locomotive and products to practically all foreign countries through its own representatives, located in all parts of the world. An agreement has also been effected whereby the Baldwin Locomotive Works, through its domestic offices, will handle the railway field sales in the United States for the George D. Whitcomb Co.

Highway Shoulder Machine Co., Effingham, Ill., has announced the appointment of William M. Bennett as Sales Manager. Mr. Bennett was formerly connected with the Lehigh Portland Cement Co.

Hercules Products, Inc., Evansville, Ind., has recently purchased the plant and mill equipment of the Boekstege Furniture Co., valued, with new equipment to be installed, at approximately $500,000. The plant is located at Franklin Street and 7th Avenue and provides for additional Hercules production approximately 113,000 square feet of floor space and will be used entirely for the manufacture of Hercules Better Business Bodies. A new plant at Walkerville, Ontario, built by the Hoffman Construction Co., has been completed and in a few weeks when equipment has been installed will furnish additional manufacturing facilities for 400 to 500 Better Business Bodies daily.

The Portland Cement Association, 33 West Grand Ave., Chicago, Ill., has announced the appointment of Charles A. Clark as Manager of the Southwestern offices of the Association with headquarters at Kansas City. Mr. Clark has been with the Association since 1917. After a period of administrative work in the Chicago general office, he was assigned to Dallas as District Engineer. In assuming his enlarged work at the Kansas City office, he will have supervision over the territory comprising Texas, Oklahoma, Kansas, Nebraska and Western Missouri, succeeding Forest Kaufman, resigned.

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Save time and expense on your concrete road construction by securing all your reinforcing products from one dependable source. Truscon Highway Products are a complete line of highest quality.

TRUSCON WELDED STEEL FABRIC AND REINFORCING BARS reinforce the Concrete to prevent cracking.

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TRUSCON DOWEL CONTRACTION JOINTS provide a positive plane for expansion and contraction.

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Handbook on Modern Road Construction sent to engineers and contractors on request.

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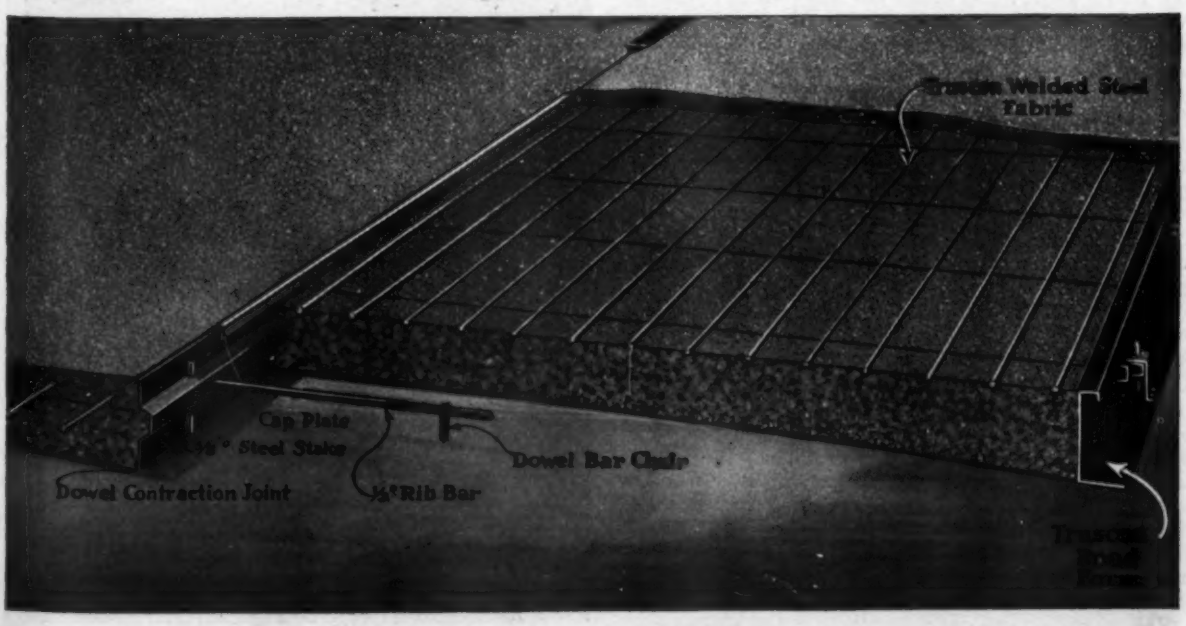


Fireproof Products Co., 536 East 133rd Street, New York, moved its Newark, N. J., warehouse and office on April 1 from 179-181 Ogden Street, Newark, to larger quarters and a more modern building at 271-277 Badger Avenue, where its complete line of steel windows, reinforcing bars and mesh, waterproofings, metal lath, corner beads, contractors equipment and firesafe building products are to be located hereafter.

McEverlast, Inc., of Los Angeles, Calif., owner of the Hunt Process for curing concrete roads, has opened a general Eastern sales office at 1754 Graybar Building, 420 Lexington Ave., New York.

The Lincoln Electric Co., Cleveland, Ohio, has announced that J. C. Lincoln, formerly President, has been elevated to the position of Chairman of the Board of Directors and J. F. Lincoln, formerly Vice-President, has been made President.

The American Institute of Steel Construction, Inc., New York, has announced that on April 1 its offices were moved to 200 Madison Avenue, New York.

A New Combination of Construction Equipment Manufacturers

A $125,000,000 organization known as the United Tractor and Equipment Corp., 612 North Michigan Ave., Chicago, Ill., has been formed by thirty-two large independent makers and distributors of tractors and industrial equipment in North America for the cooperative manufacturing and marketing of their products. Through several hundred selected dealers in the United States and Canada the members, including fifteen manufacturers and seventeen distributors, will market a full line of industrial tractor equipment designed to be operated with the United Tractor which is now in full production under contract by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Enrolled in the corporation membership are the following manufacturers: Allis-Chalmers Mfg. Co., tractors, the Wehr Co., road building machinery and rubber-tired industrial wheels, and the Trackson Co., logging hitches, full crawler attachments, cranes, bulldozers and backfillers, all of Milwaukee, Wis.; Brookville Locomotive Co., gasoline locomotives, Brookville, Pa.; Dorsey Bros., stump pullers and land clearing equipment, Alba, Ala.; Hughes-Keenan Co., Iron Mule self-contained dump tractors and the Roderick Lean Mfg. Co., field type disc harrows, Mansfield, Ohio; C. H. Turner Mfg. Co., saw mill equipment and cordwood saws, Statesville, N. C.; the Perry Co., scrapers, Sidney, Ohio; Muskogee Iron Works, double and single drum hoists and oil field equipment, Muskogee, Okla.; Brenneis Mfg. Co., orchard harrows, Los Angeles, Calif.; Ferguson Mfg. Co., wheelless plows, Evansville, Ind.; Universal Power Shovel Co., power shovels, Detroit, Mich.; Athens Plow Co., trailing and side disc plows, Athens, Tenn.; Moline Implement Co., general line of agricultural implements, Moline, Ill.

Distributors in the corporation are the Howard-Cooper Corp., Portland, Ore.; O. R. Peterson Co., Inc., San Francisco, Calif.; B. Hayman Co., Inc., Los Angeles; Ferris Tractor Co., Dallas, Texas; Thompson Automobile & Machinery Co., New Orleans, La.; Dealers Equipment and Implement Co., Memphis, Tenn.; Truck Tractor Equipment Co., Columbus, Ohio; Motor Power Equipment Co., St. Paul, Minn.; W. B. May, Inc., Buffalo, N. Y.; Cunningham-Ortmayer Co., Milwaukee, Wis.; C. V. Ruble, Kansas City, Mo.; C. H. Turner Mfg. Co., Statesville, N. C.; John M. Brandt, Bushnell, Ill.; Dealers Equipment Co., Oklahoma City, Okla.; C. W. Bull Equipment Co., Houston, Texas; British Columbia Tractor Equipment, Ltd., Vancouver, B. C.; George A. Clark, Toronto, Ont.

The officers of the Corporation are: Milton W. Anderson, President and General Manager; W. B. May of W. B. May Inc., Buffalo, N. Y., Vice-President; W. R. Wehr, the Wehr Co., Milwaukee, Secretary-Treasurer; Walter Stiemke, the Trackson Co., Milwaukee, Assistant Secretary-Treasurer.

Directors include President Anderson, Walter Stiemke, E. R. Wehr, W. B. May and H. C. Merritt, Allis-Chalmers Mfg. Co., Milwaukee; Arthur S. Hughes, Hughes-Keenan Co., Mansfield, Ohio; Robert Lea, Moline Implement Co., Moline, Ill.; A. W. Logan, Motor Power Equipment Co., St. Paul; B. C. Thompson, Thompson Auto and Machinery Co., New Orleans, La.

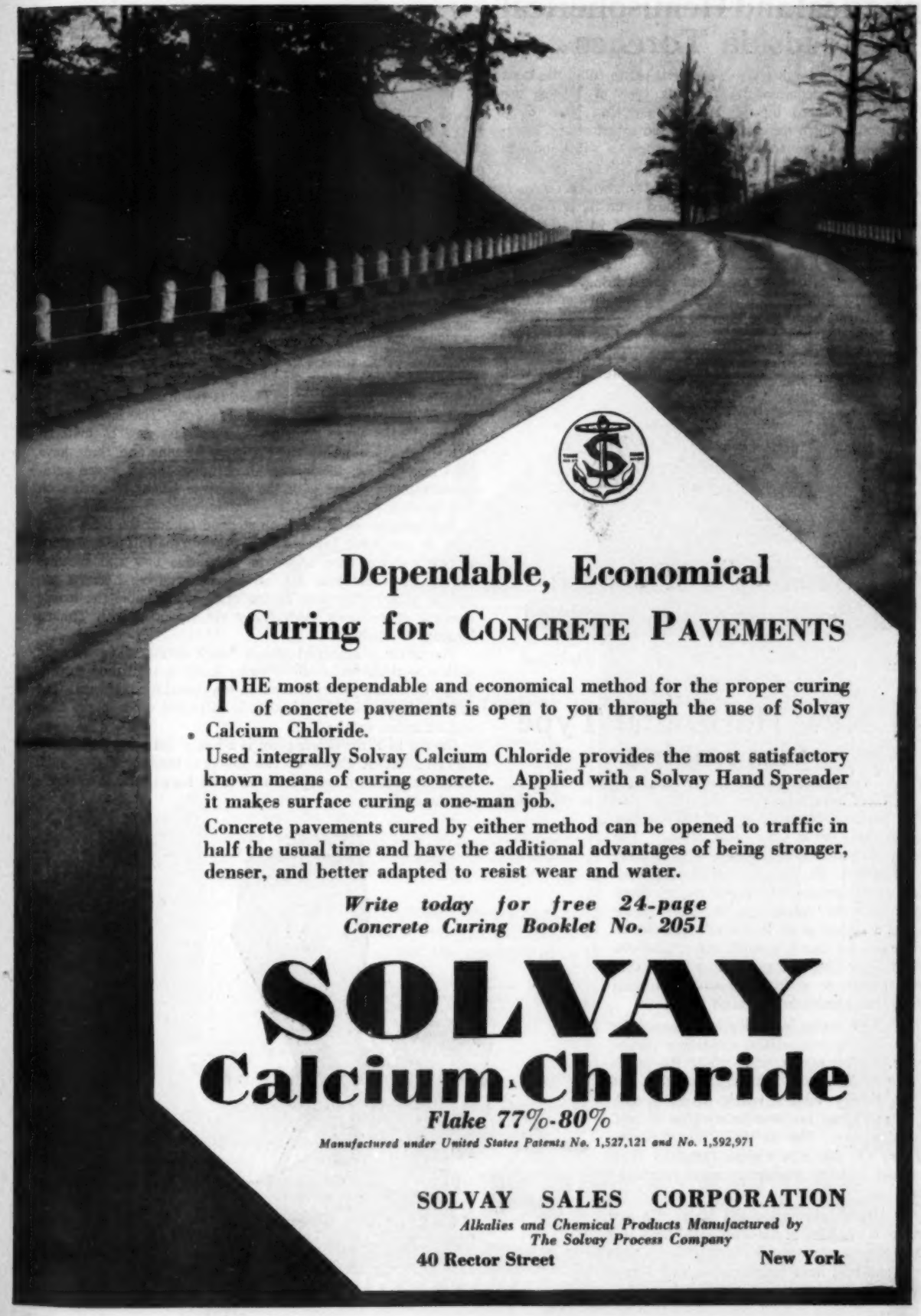
Committee chairmen are: Sales Promotion and Advertising, Walter Stiemke; Manufacturers, H. C. Merritt; Territorial and Membership, K. J. Miller, Truck Tractor Equipment Co., Columbus, Ohio; Adjustment, J. W. Ferris, Ferris Tractor Co., Dallas, Texas; Export, C. H. Turner, Turner Mfg. Co., Statesville, N. C.; Finance, A. G. Stratton, Agricultural Bond and Credit Corp., Chicago.

Tractor Carries Heavy Burden of Brick

THE Gerlinger hydraulic carrier made by the New York Air Brake Co., Carrier Division, 420 Lexington Avenue, New York, and described in the March issue of CONTRACTORS AND ENGINEERS MONTHLY has many effective applications for the paving contractor. Among them may be cited particularly the transportation of lumber, reinforcing steel, bags of cement and loads of brick as shown below.

A Load of Brick Ready to Be Picked Up by the Hydraulic Carrier

An Hydraulic Carrier with a Load of Brick



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Used integrally Solvay Calcium Chloride provides the most satisfactory known means of curing concrete. Applied with a Solvay Hand Spreader it makes surface curing a one-man job.

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40 Rector Street **New York**

Spherical and Hemispherical Roadside Torches

ROADSIDE torches which are designed to fulfill the most exacting requirements for this type of service are manufactured by the R. E. Dietz Co., New York. These torches which are made in both the spherical and hemispherical styles, are solidly built of steel to withstand the rough usage such torches are subjected to.

The spherical torch has a weighted bottom which causes it to return to position if tipped or knocked over. It is 7 inches high, 7¾ inches in diameter, has a capacity of 96 fluid ounces and burns more than 24 hours.

The hemispherical torch has a broad flat stable base with curving sides that operate as a fend against injury. It is 5½ inches high, 7¾ inches in diameter with a capacity of 80 fluid ounces and will burn more than 20 hours.

Both styles of torch burn kerosene, light fuel oil or crude distillate. Each is provided with a cast steel burner, heavy carrying loop and an automatic lock which prevents the wick from dropping inside.

The Stover Horizontal Engine with One Fly-Wheel Removed

A New Horizontal Type Gas Engine

ON practically all horizontal engines up to this time, there have been from 12 to 15 oil holes or cups which have to be supplied with oil at least once an hour or, in some cases, oftener. The Stover Manufacturing & Engine Co., 25 Lake St., Freeport, Ill., in the new Stover horizonal type, completely enclosed engine, lubricates with the splash system. This engine carries a supply of oil in a crank case like an automobile or like a vertical engine, and the splash lubricating system provides for its constant automatic distribution to all working parts, thus eliminating all hand oiling.

This new engine is particularly adapted for operating concrete mixers, diaphragm pumps, hoists, sawing outfits, etc., where the air is apt to be filled with dust, sand, sawdust and other foreign matter which naturally falls upon and clings to the ordinary type of horizontal engine. The oil tank crank case enclosure on this new engine forestalls these troubles and the consequent wear caused by them.

By careful preparation and design this new engine is available at the same price for which the former open type horizontal engine was sold, and it is interchangeable with all Stover engines of the same size already in the field.

The Dietz Spherical Roadside Torch

The Dietz Hemispherical Road Torch

A New and Faster Paver

THE new 1929 MultiFoote paver which is manufactured by the Foote Co., Inc., Nunda, N. Y., has a number of improvements and new features which go to increase the speed of its performance. The frame has been made heavier and stronger, a new method of boom suspension and a new simplified boom drive have been adopted. The double cone drum is 4 inches longer, and has been raised in order to give the top speed of discharge. There is no mechanism inside to clog or delay the mixing scouring action. The loading skip is placed at a sharp angle to insure a fast flow of material into the drum and both the discharge opening and chute have been made larger. The power discharge is the improved automatic planetary type with the discharge height 69 inches on both Models 13-E and 27-E.

The hoisting speed has been stepped up and the hoist fitted with an automatic knockout. Every automatic feature which is practical has been added to make this new and speedier paver. The rear axle and all important driving shafts are chrome nickel alloy steel having more than double the tensile strength of ordinary steel. They are equipped with Timken bearings throughout.

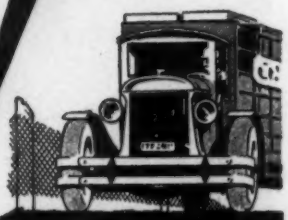
The paver is equipped with a 9-inch double channel boom, with a working radius of 20 feet. It has a triple-line suspension with a hand-wheel located on the operator's platform. The full batch spreader type bucket is 44 inches wide on the 13-E and 60 inches on the 27-E.

On the 13-E the power plant is a heavy duty 4-cylinder Hercules motor. A choice of two different models of 6-cylinder Hercules motors ranging from 53 to 65 horsepower is available on the 27-E.

The New 1929 Multi-Foote Speed Paver

Strength!

*Points to consider in selecting culverts and drains: No. 2**



1

2

Make this mailing tube test—

You can prove for yourself the strength of a flexible structure. Do this—

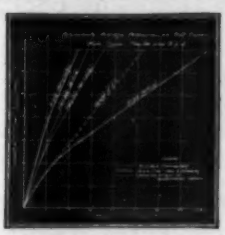
1. Hold the tube between your thumb and finger—you will find that a little pressure crushes the tube.

2. Hold the tube in your full hand—you will find that with the pressure equalized over the full circumference, the tube can hardly be broken.

Armco Culverts, because they are flexible, distribute loads over the full circumference—they get the strength of all of the culvert.

Armco Culverts and Drains are manufactured from the Armco Ingot Iron of the American Rolling Mill Company and always bear its brand

Armco Culvert Mfrs. Association
Middletown, Ohio



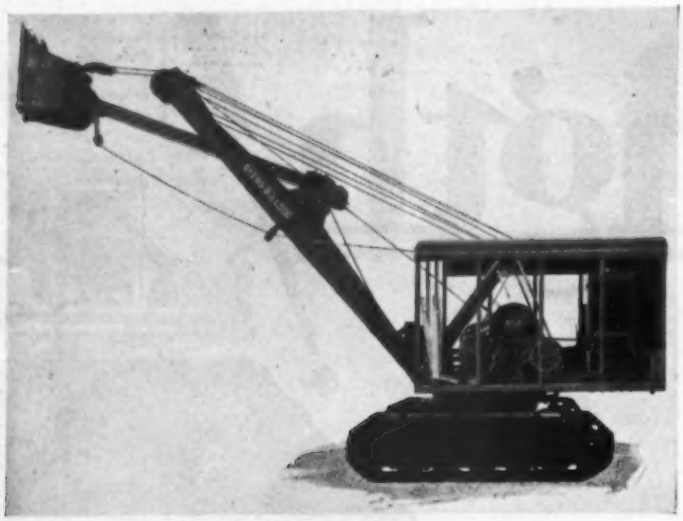
A bulletin "Basing Confidence in Culvert Strength on Engineering Facts" gives facts on culvert strength as determined in tests conducted by such authoritative bodies as the American Railway Engineering Assn. A copy on request.

*No. 3 of this series appears in June

ARMCO CULVERTS

"Look under your roads"

© 1929, A. C. M. A.



The Byers Bulldog Convertible Shovel

A Convertible ½-Yard Shovel

THE ½-yard Byers Bulldog manufactured by the Byers Machine Co., Ravenna, Ohio, is a unit designed to operate with shovel, crane, skimmer or trencher attachments without any mechanical changes except replacing one boom with another at the hinge pin, adding drum logging and re-reaving the cable. It performs equally well with a clamshell, dragline, hookblock, pile driver or magnet on a 35-foot crane boom.

The frames and car body are of cast steel, riveted and bolted to the turntable which is also of cast steel and revolves around a large center pin. These castings are rugged enough to hold all shafts against strains.

The full ½-yard heavy duty dipper on a 14-foot dipper stick and an 18-foot shovel boom is standard equipment. The smallest working sheaves are 16-inches in diameter and free rotating. The crowd action is by two cables operated from either end of the dipper stick and running down to the shock absorbers at the base of the boom which relieve the drum shafting from undue shocks and strains. The dipper has manganese steel reversible teeth and the back drop plate and latch are tough alloy steel.

The standard 35-foot crane boom is strongly riveted and bolted, a parabolic latticed structure with a wide base at the hinge pin to insure against twist. The boom head guard is a heavy plate of steel to protect the sheave against bumping by the bucket or hookblock when the attachment is raised to full height.

For digging trenches, for sewer and water lines, irrigation ditches and excavating for basements, the trencher is economical and serviceable. The standard bucket widths are 25 inches, 31 inches and 37 inches. The trencher arm pulls with a powerful stroke, and the construction in the boom, arm and bucket allows digging in unusually hard materials. The trencher is one-man operated like the other Byers tools. The three-lever operation allows the boom to be raised while swinging, thus speeding up the number of trips per minute.

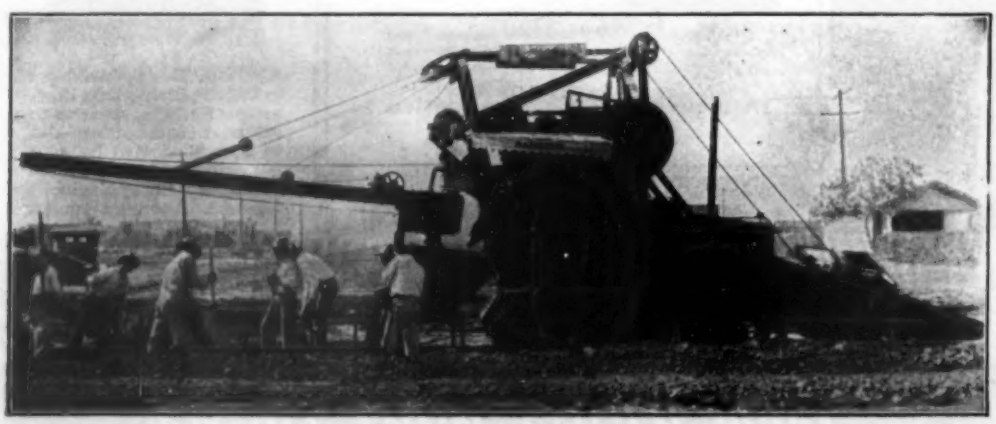
The Byers skimmer boom is slightly goose-necked and fits in the main casting. The ½-yard drop-bottom scoop rides under the long boom on bronze bearing rollers. The teeth are strong alloy steel, and the dipper is the bottom-drop type with rugged latch, bar and hinges. The boom is of strongly bolted and riveted structural steel with the bottom side flanged for the scoop roller track. Bumpers at both extremes of the bucket stroke absorb shocks and relieve the boom from the sudden strains of the bucket travel.

A 58-horsepower motor which develops a 7,800-pound single line pull furnishes the power which is transmitted to all working drums by one intermediate shaft—the Byers direct-drive design. This jackshaft receives the power on a silent chain drive and the two small pinions contact the double drums and swing shaft. Timken roller bearings which are self-aligning hold the jackshaft in absolute alignment.

A Powerful and Speedy Paver

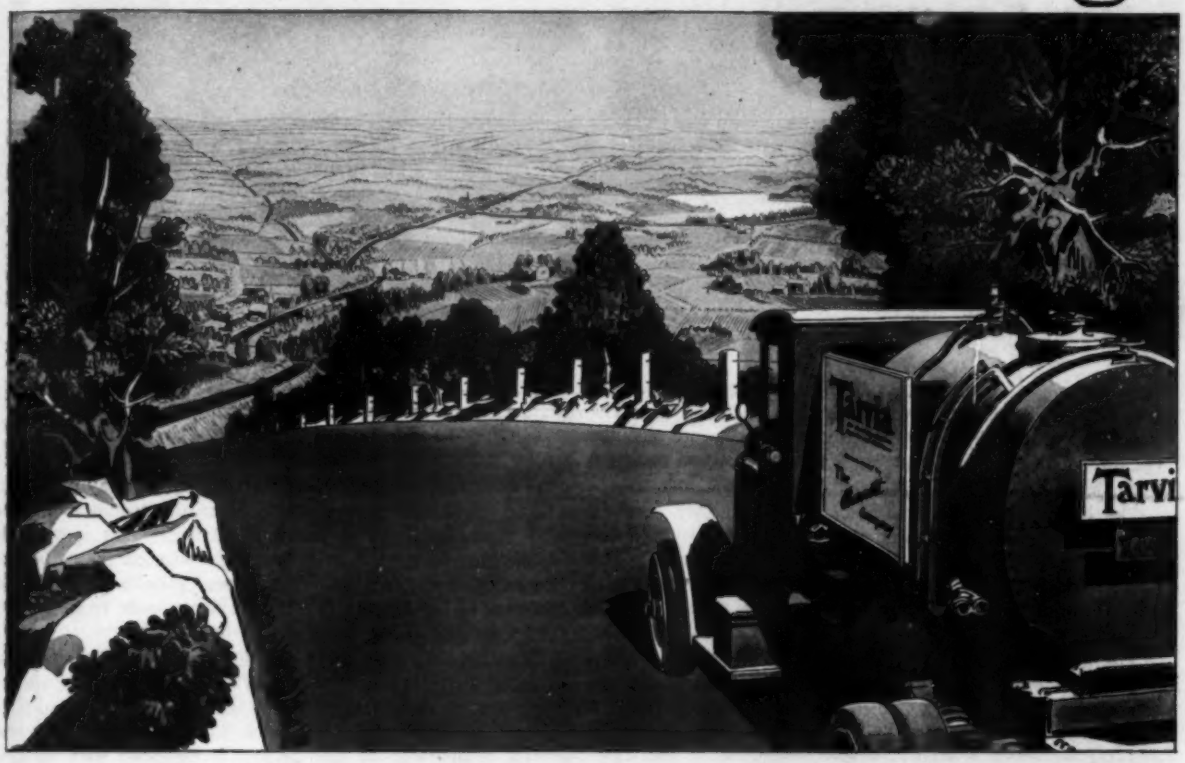
THE Ransome 27-E master paver which is manufactured by the Ransome Concrete Machinery Co., Dunellen, N. J., has a number of outstanding features of interest to contractors and road builders. The master paver has an extra heavy power loader skip the standard size of which is 8 feet 1 inch in clear and the portion resting on the grade is approximately 6 feet 6 inches long, giving a floor area of 52 square feet. Under ordinary working conditions the load is all out of the skip in 11 to 14 seconds after starting the hoist clutch. The water tank of this paver maintains an accurate delivery of water under all conditions or in any position of the paver. It is not affected by grades or side elevations.

The drum is 66 inches in diameter and 54 inches long inside measurements and is made of steel plate which can



The New Ransome 27-E Master Paver

2,484,822 miles to go



WITH twenty-five years of road building activity behind it, America has completed only about 17 per cent of the job. The tally reads: improved roads, 521,259 miles; unimproved, 2,484,822 miles.

On every side there are elements at work that are forcing the development of the unimproved 83 per cent. On every side new radii of activity are making America more and more travel-minded.

Road building must continue to be one of the nation's principal occupations—the familiar Tarvia distributor truck a common sight on our roads. For Tarvia construction and maintenance make it possible for all communities to have hard-surfaced, stormproof, skid-safe roads without excessive taxation or straining of budgets.

Get the facts about Tarvia

Whatever the type or extent of road work on your program, Barrett can help you—

With an efficient Barrett service and a grade of Tarvia which is definitely right for every paving requirement.

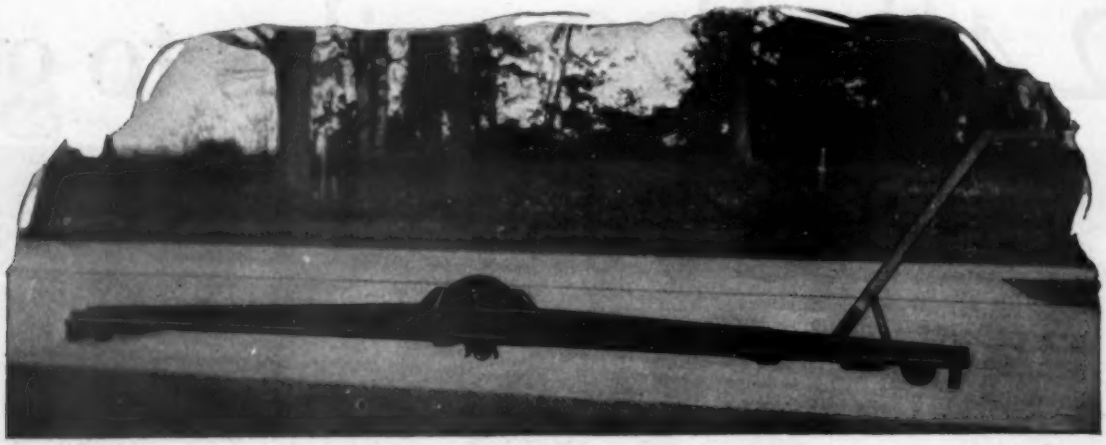
Why not investigate what a Tarvia program would mean for your community? Write, wire or 'phone our nearest office for the Tarvia field man.

The Barrett Company

New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Birmingham
Buffalo	Kansas City	Columbus
Providence	Syracuse	Milwaukee
Baltimore	Toledo	Cincinnati
Lebanon	Youngstown	Rochester
		Bethlehem

In Canada:
THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

Tarvia
FOR ROAD CONSTRUCTION
REPAIR and MAINTENANCE



The Olsen Road Surface Rater

not be broken. Within the drum are five mixing blades and ten pick-up buckets which insure a perfect mix. The drum rollers on which the traction rings run are genuine car wheels, 16 inches in diameter, 3½-inch face, and equipped with two Timken tapered roller bearings in the hub.

The Ransome paver discharges a full batch in 8 seconds. The discharge chute is round and comes clear out to the sides of the 24-inch discharge opening in the drum. The chute is of 5/16-inch plate, is entirely outside the drum and has an upper covering or protecting plate which protects the boom seat, sheaves and ropes from the concrete.

The average length of the boom is 22 feet and it has a 170 degree swing. It is made of two 9-inch, 13.4-pound channels with 1½-inch x ½-inch renewable tracks on the bottom flanges of the channel. It is easily swung by a worm and segment with a large diameter handwheel. The boom bucket has a 42 cubic foot water level capacity.

The main frame of the paver is strong and sturdy in construction. All parts of the transmission are carried in case steel cradles, a Ransome feature to insure easy running and long life. An engine developing 65 horespower at 1,080 r.p.m. furnishes excess power for the paver.

The Ransome may also be equipped with a calcium chloride attachment, consisting of one tank having an upper and lower compartment which is set on the paver frame, with a power driven agitator in the upper compartment. A flexible hose goes from the lower compartment to the three-way valve on the measuring tank mounted on the side of the power loader skip, and another hose goes from the three-way valve to the paver drum. The exact amount of the solution for each batch is determined by the position of the end of the pipe in the measuring tank, which is adjusted by means of a screw.

Tractor in New Size Makes Line of Small Machines Complete

A NEW tractor known as the Caterpillar Fifteen has recently been put on the market by the Caterpillar Tractor Co., San Leandro, Calif., and completes the line of small tractors, giving the contractors three sizes aimed to fill any need for a track-type tractor.

In design the Fifteen is a replica of the Ten, with the exception that it is something larger and more powerful. This tractor will work the year round, under any kind of weather conditions, and may be used with some twenty-five kinds of trailer equipment.

A Machine for Testing Road Surfaces

MODERN specifications for concrete highway pavements limit the surface variation, usually to not more than ¼-inch plus or minus in 10 feet. This is generally determined by using a wooden straight-edge on the surface of the road, moving it half its length longitudinally and observing the surface beneath it. This is an arduous task, requiring several men and taking considerable time.

The Tinius Olsen Testing Co., 500 North 12th Street, Philadelphia, Pa., has recently put on the market a road surface rater for detecting and indicating unevenness in road surfaces which does this work quickly and accurately. This rater, which is operated by one person, is equipped with scrapers and an indicator, so that the inspector can observe the amount, either plus or minus, of the variation as well as where the variations occur.

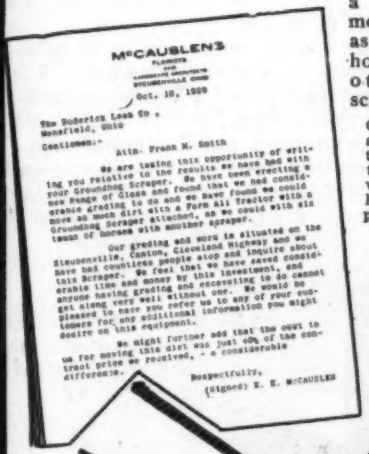
This rater, which is the standard 10-foot length, weighs about 60 pounds and is so designed and constructed that it is easily transported. It is also easily adjusted in the field, the only tools required being a metal gage ¼-inch wide, two small wooden blocks, a piece of thread and a pair of pliers. The use of this device makes for better roads with greater ease in determing their smoothness.

The New Caterpillar Fifteen

"GROUNDHOG"
REVOLVING TRACTOR SCRAPER

SAVES 60%

McCauslens, prominent landscape architects of eastern Ohio, were able, with the "GROUNDHOG," to save 60% on their grading costs, as compared with their usual costs for this work when other scrapers were used.
Mr. McCauslen's letter, reproduced below states—
"One 'GROUNDHOG' attached to a tractor could move as much dirt as six teams of horses using another type of scraper."



McCAUSLENS
LANDSCAPE ARCHITECTS AND CONTRACTORS
STEUBENVILLE OHIO

Oct. 10, 1929

The Roderick Lean Co.,
Mansfield, Ohio
Gentlemen:-
Attn: Frank M. Smith

We are taking this opportunity of writing you relative to the results we have had with your Groundhog Scraper. We have been erecting a new range of glass and found that we had considerable grading to do and we have found we could move as much dirt with a Farm All Tractor with a Groundhog Scraper attached, as we could with six teams of horses with another scraper.

Our grading and work is situated on the New York, Cleveland Highway and we have had countless people stop and inquire about this Scraper. We feel that we have saved considerable time and money by this investment, and anyone having grading and excavating to do cannot get along very well without one. We would be pleased to have you refer us to any of your customers for any additional information you might desire on this equipment.

We might further add that the cost to us for moving this dirt was just 40% of the contract price we received, - a considerable difference.

Respectfully,
(Signed) R. E. McCAUSLEN

Can be used with any type of tractor. Positive control — continuous work. Write for literature and prices.

THE RODERICK LEAN COMPANY
Dept. 9
Mansfield, Ohio
U. S. A.

A long lever regulates the depth of cut—enables the operator to bite as deep as he wants and to stop loading instantly—no stalling, no overloading—the control for loading, dumping and spreading is simple and positive.

The "GROUNDHOG"
REVOLVING TRACTOR SCRAPER

BUY BOSS MIXERS and HOISTS DIRECT FROM FACTORY

YOU GET SALESMAN'S & JOBBER'S PROFIT!

SAVE $42 to over $384 ON EACH MACHINE

Every manufacturer is trying to reduce his selling costs. We have found the way and are going to give the difference to our customers in order to increase our sales. We have done away with all our salesmen and jobbers and are now selling direct to users. We have deducted the salesman's and jobber's commission from each machine and the difference is our price to you. This is the most astonishing news in the construction industry and it is certainly paying us as sales are jumping by leaps and bounds. Get the new catalogue with new confidential wholesale prices on each machine. It shows the most popular types and combinations, describing each fully—with new price. The coupon will bring it.

SAME HIGH QUALITY

Regardless of this drastic price cut, the quality of BOSS Mixers and Hoists remains the same. They have always been noted for their heavy duty construction and materials. Under no consideration will we ever sacrifice this reputation. Get the catalogue. Note the specifications and compare the prices. You get the same patented Re-Mixing Action and other exclusive features that have made BOSSES preferred wherever used. Hundreds of BOSS machines have ten, twelve and fifteen years of continuous service behind them and still going strong. For quality of design, materials and construction we defy anyone to find a better built machine than a BOSS. You can now get all this for less.

BOSS 14S NON TILTER "One-Two Bagger" patented reuniting action, steel construction, high speed performance with one man control.

Get Our Prices

Send Coupon for New Catalogue With Confidential Wholesale Prices

The new BOSS Catalogue gives complete information on all the BOSS Mixers, Pavers and Hoists along with the new confidential wholesale prices. Even if you do not want to order now, get this new catalogue and keep it on hand for future use. Fill in the coupon and mail today. It will save you money. Though you may have bought direct from a manufacturer before you have never been able to buy at these prices because no salesman's or jobber's commission is figured in. Prices on every machine are greatly reduced. Get the new catalogue with wholesale prices.

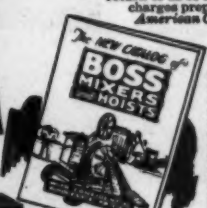
A COMPLETE LINE

We make over 70 various sizes, combinations and types of BOSS Mixers, Hoists and Pavers. There is a type for every conceivable use. Get the new catalogue first, then decide. Often our customers find that they can use a much lower priced machine after studying this catalogue. There is no need of going elsewhere for a certain machine when it is in the BOSS line. Write for catalogue and confidential wholesale prices; also give us information on kind of work you want the machine for. We can probably be of help to you.

1 YEAR GUARANTEE

GUARANTEE—All BOSS equipment is guaranteed for one year against defective materials and inferior workmanship. Any parts proving defective will be replaced free of charge (electrical or engine equipment excepted, as this equipment is guaranteed by the respective engine manufacturers) upon return to us of defective parts, carrier charges prepaid for our inspection.
American Cement Mach. Co., Inc.

NEW CATALOG WITH WHOLESALE PRICES TELLS ALL!



THE BOSS 8½S NON TILTER. One half bag drum type trailer mixer with 2 disc wheels, cushion rubber tires, batch hopper, 2 HP Clinton engine, magneto, steel engine housing.

5 DAYS' FREE TRIAL

So confident are we that every BOSS Mixer and Hoist will give complete satisfaction, that we offer you five days' free trial. Order a BOSS. Use it in the field. If within five days you do not find it exactly as represented in every way, send for return instructions and refund of purchase price. This protects you; you can't go wrong on a BOSS. As long as we have sold on this basis, we have never had a customer demand his money. This proves BOSS quality. Every BOSS machine is backed up with an iron clad guarantee. Read it above.

CLIP AND MAIL THIS COUPON NOW!

GET OUR PRICES

CLIP AND MAIL THIS COUPON

AMERICAN CEMENT MACHINE CO.,
236 S. Fourth St., Keokuk, Iowa.

Send me your new catalogue showing complete line of BOSS Mixers, Pavers and Hoists with confidential wholesale prices.

Name _____

Address _____

Town _____ State _____

The New Type-G Erie Aggremeter Plant

A Portable Two-Piece Plant for Measuring Aggregates

A NEW portable two-piece aggremeter plant, known as Type-G, has recently been designed by the Erie Steel Construction Co., Erie, Pa. This plant is especially suited for road and general contracting work where portability is essential and it can also be adapted to central mixing plants for loading directly into the mixer hopper.

The bin in this new plant is of special design, making it especially adapted to use with platform-operated Aggremeters. The bin bottom is off center, which allows more floor area and shelter for the operator. It is also impossible for the aggregates to arch in the bin because the sides are almost perpendicular.

The capacities of these bins are 60, 73, 74 and 91 tons. The 60- and 74-ton capacity bins are shipped in two pieces with the Aggremeter attached so that it is necessary only to put the two sections together. On these bins the top section is flared on two ends only. The 73- and 91-ton capacity bins have four flared sides to the top section. They are shipped in two main sections and one top section. The flare top is assembled on the ground and then attached to the top section. The 60- or 73-ton bins may be converted into a larger bin by adding the correct top section.

The total weight of the Type-G Aggremeter plant is so divided that an ordinary crane can handle the sections with ease. They can be moved from place to place on a trailer or flat car, and but a short time is required to attach the top section to the bottom and get the plant ready for use.

Among the interesting articles to be included in the May issue of CONTRACTORS AND ENGINEERS MONTHLY, *will be an exceedingly valuable article on the establishing of a cost system for equipment.*

A Trailer Chip Spreader With Removable Side Wing Pans

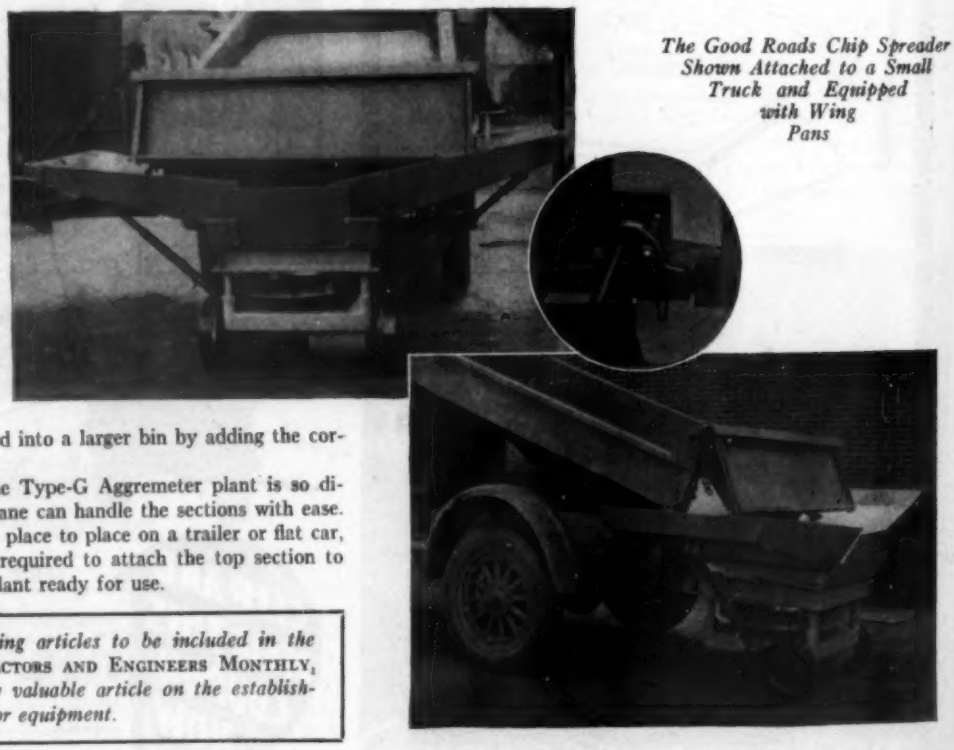
A HUSKY chip spreader of the trailer traction type is made by the Good Roads Machinery Co., Kennett Square, Pa. This spreader is designed with removable side wing pans in order to meet the needs of those having trucks with full width tailgates. Side pans are adjustable to suit various height truck bodies.

For trucks with small control gates at the rear to regulate the stream of chips flowing into the spreader the use of the wing pan is not required and therefore the spreaders are furnished with or without these wing pans as desired.

The main frame is a steel casting weighing over 200 pounds. All the bearings, as well as the sockets for the hopper legs, are cast integral. A steel housing is attached around the drive mechanism and all Alemite connections are brought to convenient locations. The wheels are cast steel, 12 inches in diameter and smooth tread. The hopper consists of a 4-inch channel frame with a heavy bottom plate. The opening in the plate is reinforced with a steel ring.

The flow of material to the spinner disc is controlled by a cast cone with a clamp washer readily moved to suspend the cone in any desired position. The spinner disc is 28 inches in diameter, of 3/16-inch steel plate, and is carried on a ball thrust bearing. A series of vanes to accelerate the travel of the chips are welded to the disc.

The height of the spreader, with wings, is 48 inches, the width 82 to 96 inches, the length, over tongues, 55 inches, and the width of the spread 12 feet at 2 miles per hour. For ready attaching to various trucks, the two steel tongues are adjustable and each carries a special coupling hook. For convenience in transporting from place to place the spreader can be raised clear of the ground to the required clearance and supported by two chains attaching to the upper section of the truck body.

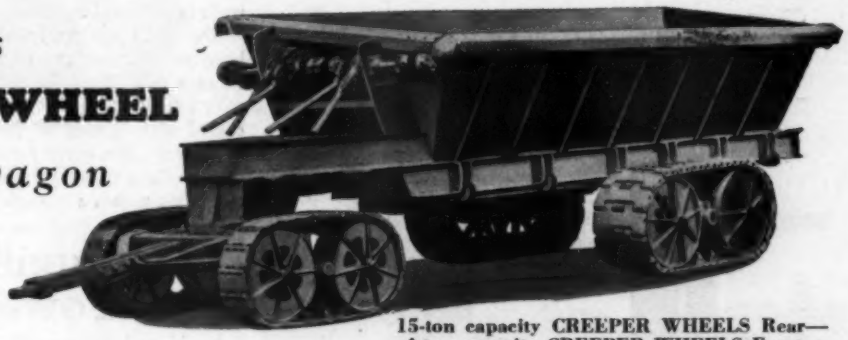


The Good Roads Chip Spreader Shown Attached to a Small Truck and Equipped with Wing Pans

This

CREEPER WHEEL

equipped wagon hauls 20 yards rounded load



15-ton capacity CREEPER WHEELS Rear—
4-ton capacity CREEPER WHEELS Front—
on this elevating grader style wagon with low left side.

CREEPER WHEEL equipped wagons will work continuously—rain or shine, in mud or dry drt—the shovel or grader is never idle a minute when CREEPER WHEEL equipment is doing the hauling.

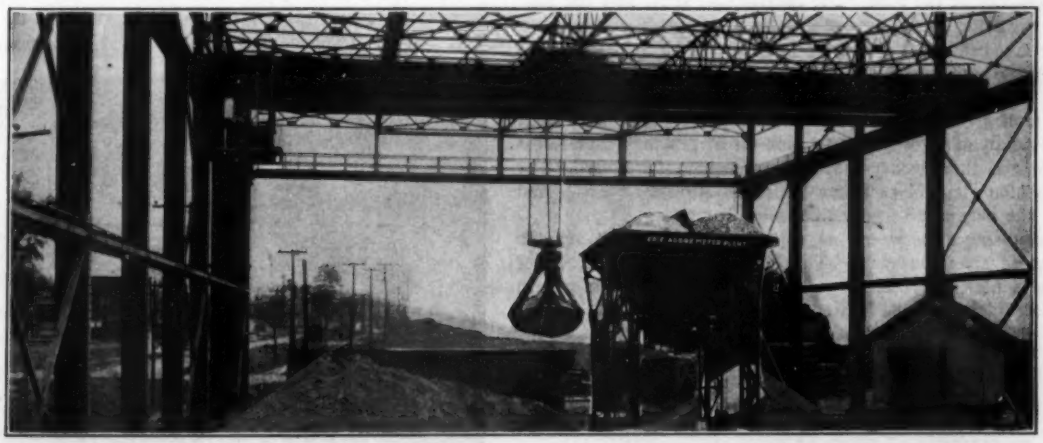
Your profit is materially increased or decreased according to the time saved or lost in moving dirt—therefore, equipment that will make possible the hauling of dirt, regardless of weather conditions, should be of vital importance.

Why not use CREEPER WHEEL *Equipment in your hauling and note the difference?*

Booklet sent on request

THE CREEPER WHEEL COMPANY

602 Colonial Trust Building — Reading, Pennsylvania



We Design, Manufacture and Erect COMPLETE MATERIAL YARDS

Take a look at the illustration above—Clever? You bet! And the Owners claim it is a moneysaver too. Why? —One crane operator for the entire yard.—No stand-by expense—Every square foot of ground space used—Low maintenance, no shut downs. Efficient: more work per dollar spent—Accurate: overhead control of the entire yard. Let us revamp your old, or design your new material yard. Please write for details.

BUCKETS
Electric Power-Arm or Clam-shell Buckets made in ½ to 5 cu. yds. capacity. They are all diggers. Send for catalog.

AGGREMETERS
Volume or Volume-Weighing. The correct way to proportion aggregates. Write for literature.

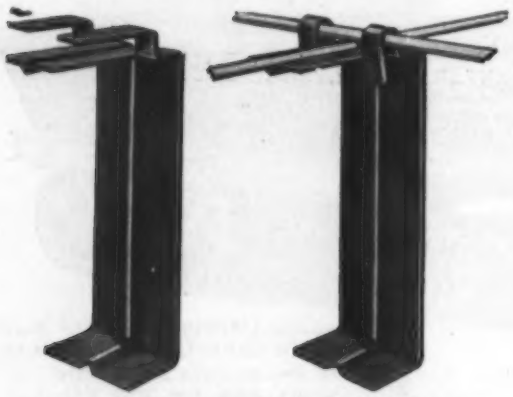
AGGREMETER PLANTS
25 to 237 tons capacity. Larger sizes special. We also build Central Mixing Plants to suit your needs.

OVERHEAD CRANES
They need no introduction. The chief characteristics: Low operating and maintenance costs. Roller Bearings or Bronze Bushings optional.

STEEL CONSTRUCTION
No job too large or too small. Get our prices.

Tell Us Your Problems

ERIE STEEL CONSTRUCTION CO.
ERIE, PENNA.



The New Double Lip Rod Clamp for Holding Reinforcing Steel, Before and After Locking the Bars

A New Support for Wire Mesh Concrete Road Reinforcement

THE prevailing practice for placing wire mesh reinforcement is to pour one layer of concrete, place the mesh on this layer and finish the slab with another layer of concrete. This practice makes it necessary to pour split batches, less than the capacity of the mixer and thus slows down the whole job. The Highway Steel Products Co., 14th & McKinley Sts., Chicago Heights, Ill., has developed a new wire mesh support which makes it possible to place the mesh before any concrete is poured.

The supports are applied to the mesh while the mesh is on the shoulder of the road. The illustrations show how the supports are attached to the mesh. A small tool or a pair of pliers will easily bend over the lips of the clamps to hold the joints rigidly. Where unwelded mats of reinforcing bars are used, these supports have a two-fold purpose. Besides holding the bars at a given distance above the subgrade, the joint locks them rigidly at right angles to each other, making other forms of bar ties unnecessary where these supports are used. The clamp alone is sold as a bar tie. It is applied as easily and holds the bars more firmly than most bar ties.

The distance between the supports is dependent on the weight of the bars used. The heavier the bars, the fewer supports necessary. These supports are made to conform to all state highway specifications.

A New Year-Round Building Material

A BUILDING material which may be applied summer or winter at no greater cost than clapboards or shingles and which increases in strength with age has been developed by Harry A. Schendel, Mussey Street, South Portland, Maine. This material, known as Woodesite, is composed of a ½-inch thick fiber shiplapped insulating board combined with a ½-inch layer of stucco and chemically treated hardwood fiber plaster of secret formula, amalgamated with the insulating board, making the finished slab 1 inch thick, 18 inches wide and 48 inches long, weighing 5 pounds per square foot.

It is claimed that this material is fire, damp, sound, wind and vermin-proof, and that it can be nailed and sawed the same as wood. As these slabs are manufactured and cured in a horizontal position, their strength is uniform throughout. The tensile strength of the slab makes possible a very rigid structure to withstand wind, settling and other strains. It may be used to construct the outer walls of dwellings, schools, theatres, hotels, garages, etc., as well as for the inside partition walls in fireproof buildings and for underfloorings as a fire stop.

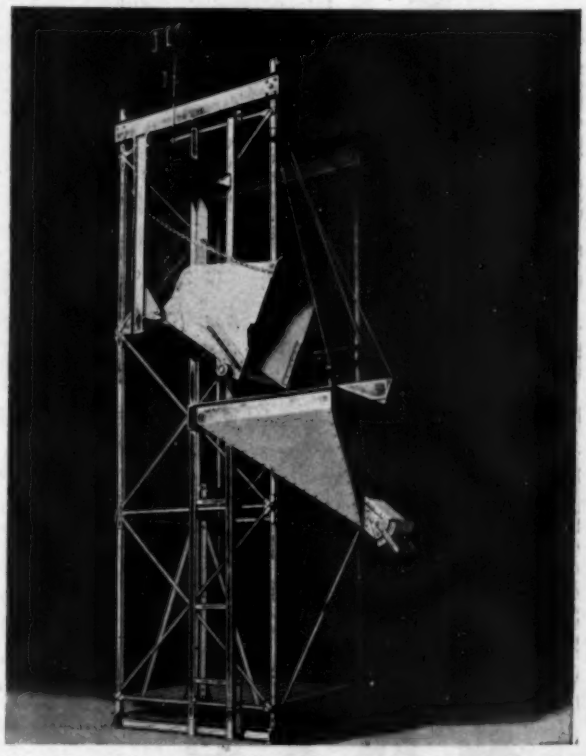
The slabs are nailed direct to wood studding which has been placed on either 12- or 16-inch centers, breaking the joints on each tier. After the slabs have been put in place and nailed with 2-inch galvanized large head nails, the entire building is coated with ¼-inch of Woodesite overlay either with a brush or trowel. The overlay can be had in most any color and in this way any design of texture or color scheme can be carried out. This makes a monolithic building without seams.

An Auxiliary Concrete Tower Elevator

AN entirely new idea in material towers has been developed by the Lakewood Engineering Co., Cleveland, Ohio. The idea of a pipe material tower is not new but the arrangement of a concrete bucket on the tower is a new and radical departure which presents new advantages. The bucket, as will be seen from the illustration, travels on the outside of the tower on a set of separate guides and is entirely independent of the material cage. It means that the contractor, with a single tower and the new Lakewood outside bucket attachment can handle concrete and materials at the same time. Heretofore, this has required a double compartment tower, greater in first cost and more expensive to assemble and erect.

The bucket can be dumped at any point from top to bottom on the tower and in addition, the bucket attachment, including the guides, can be installed on wooden towers, silos or other points where hoisting with an outside bucket is applicable.

Earlier towers of this type where equipped with a concrete bucket were designed so that the bucket had to be set on the material cage. This meant moving it in and out as operations changed from concrete to material, meant resetting of the mixer each time the change was made and did not give simultaneous operation of concrete and the hoisting of materials with a single tower as does this new piece of equipment.



The New Lakewood Auxiliary Concrete Bucket Tower Attached to a Material Tower

FLORY

FOR CONSTRUCTION WORK

THE "FLOR-OX" 35 HAS NO EQUAL!

FLORY'S New Hoist—the "FLOR-OX" 35—has many new features that make it a leader in the hoisting field. The "FLOR-OX" is marked by smoothness of operation, the utmost dependability and extreme ruggedness of construction. It can be powered by either a gasoline or electric motor and it can be altered in the field from a single to double or triple drums by bolting units together. Before you buy a hoist send for the bulletin on this new hoist. It has no equal in the general construction field.

FEATURES OF

THE "FLOR-OX" 35

ROLLER BEARING THRUSTS FOR FRICTION CLUTCHES

LESS WEIGHT AND SPACE WITH GREATER EFFICIENCY

POSITIVE RELEASE DEVICE ON FRICTION LEVERS

ALEMITE LUBRICATION

ROPE PULL OF 5000 POUNDS AT 165 FEET PER MINUTE

EXTRA HEAVY SHAFTS AND BEARINGS

SILENT CHAIN DRIVE ENCLOSED IN DUST PROOF CASING

MACHINE CUT TEETH ON ALL MAIN GEARS AND PINIONS

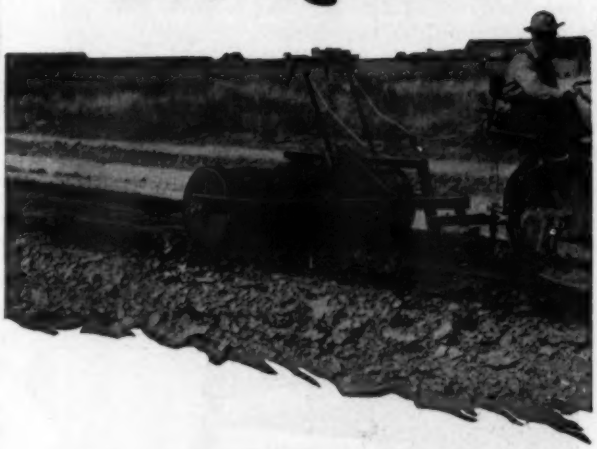
S. FLORY MFG. CO.

BANGOR, PA.

HOISTS, CABLEWAYS, CAR PULLERS, ETC.

Investigate

Killefer Scrapers—



if you want superior performance with the points of merit listed below . . .

Simple adjustment of load size to suit tractor power—

An accurately adjusted "bite"—

Heavy reversible shoes with increased wearing qualities, made by a process new to the manufacture of drag scrapers.

Two bolted-in, interchangeable blades—

Ease of control—by the tractor operator—

A full line of sizes from 4' to 8' wide, in capacities from 18 to 75 cubic feet, conservative dirt measure—

Each tool strong, heavy, and reasonably priced.

Our 7' size is shown above. These tools have been 6 years on the American market. There are hundreds of enthusiastic users.

Dealers throughout the United States and Canada. For literature write Killefer Mfg. Corp., 5525 Downey Road, Los Angeles, Calif.

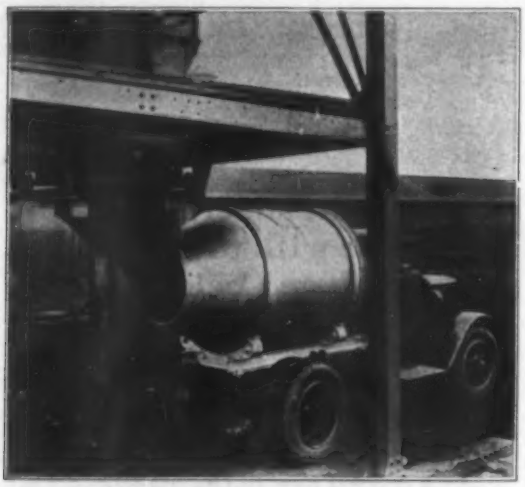
431 Fifth Street SAN FRANCISCO, CALIF.

1321 So. Washington St. PEORIA, ILLINOIS

A Three-Purpose Truck for Handling Concrete

A TRUCK which can be made to serve three purposes and is known as the Agitate-in-Transit truck mixer body, is manufactured by the Truck Mixer Co., Columbus, Ohio. These trucks have a cylindrical body made of high grade steel. A manhole in the side of the body provides an opening for loading ready-mixed concrete and the sand, gravel and cement mixture for concrete to be mixed in transit is loaded into the end of the body and the screw action carries the material into the mixing chamber.

This truck is especially adaptable as it can be made to serve three purposes. As a mixer in transit, it has a fast and thorough mixing action which insures a high quality concrete. The cement and aggregates are measured and loaded from measuring batches through the rear end of the truck into the mixing chamber. The concrete is then mixed while the truck is being driven to the job, the motor furnishing the power. The truck may be equipped with a water tank and accurate measuring gage, and water may be added as desired.



The Three-Purpose Agitate-in-Transit Truck Mixer Body for Handling Concrete

The Agitate-in-Transit body not only mixes enroute but it also may be used to haul ready-mixed concrete by merely attaching a special control discharge door. Due to variable speed controls a slow gentle continued mixing action is given the concrete as it is being hauled. The air tight arrangement of the body prevents evaporation of the water and retains the heat during winter work.

If desired, this truck can be used for hauling sand, gravel or crushed stone which is easily loaded into the truck from the bins through the hole in the side of the body.

These bodies are built in all sizes ranging from 1 to 5 cubic yards in capacity and may be mounted on practically any of the standard trucks.

An Improved Fully-Convertible Gas Shovel

THE improved Model B-3 of the Speeder Machinery Co., Cedar Rapids, Iowa, is a ½-yard full-revolving fully-convertible gas shovel which can be used as a shovel, pull-shovel, skimmer, crane, dragline or clamshell. Among its many new features are its swing speed of more than 4 complete revolutions per minute, its hoist speed of 180 feet per minute and a traveling speed of 1½ miles an hour. It will

The Improved Model B-3 Speeder Shovel

climb a 35 per cent grade and its patented traction lock eliminates the danger of slipping backwards. The Speeder two-part direct cable crowd permits the operator to shake the bucket vigorously to discharge the load, hold a smooth, level grade, dig accurately below the treads for subgrade work, crowd out and beyond the end of the boom and spot the bucket accurately.

The shovel boom length is 18 feet, the dipper stick, 13 feet and the crane and dragline booms 30 or 35 feet. The carriers for the upper body are six heavy solid steel trunnions that rotate on a large turntable which is 6 feet in diameter. The shovel is powered by a 53-horsepower gasoline engine with a 4¼ x 5¾-inch bore.

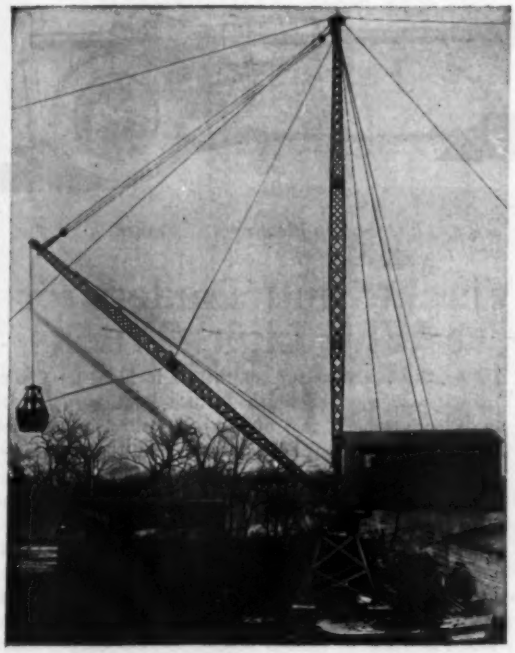
Other improvements in the shovel are heavier double tread sprockets, improved tread and drive chain tighteners, a new ultra-positive steering mechanism, larger bushed bearings, and splined shafting. An electric starter and two flood lights are part of the standard equipment.

A New Type of Blasting Machine

A NEW pocket size blasting machine, representing a new departure in American electrical machine design, has been announced by the Hercules Powder Co., Inc., Wilmington, Del. This is believed to be the first machine of American design to apply the dynamo principle to a blasting machine of such compactness. It weighs only 4¾ pounds and

The New Hercules Ten Cap Pocket Edition Blasting Machine

DOBBIE DERRICKS



DOBBIE all steel Derricks

Guarantee Safety

When you **guarantee** safety, you economize—for safety means uninterrupted operation and lowest possible maintenance costs.

And DOBBIE All-Steel Derricks have been designed for safety and consequent economy. They have a safe load capacity of almost twice their rating. You need this assurance of dependable safety and continuous performance. SAVE POWER BY USING BALL BEARING FOOTBLOCKS AND SHEAVES. Built in both Guy and Stiff-leg types. Write for information and prices.

Direct to Factory

DOBBIE FOUNDRY & MACHINE CO.
Niagara Falls, N. Y.

Timber Derrick Fittings
Sheaves—Hand-Winches—Blocks

TRADE MARK DOBBIE ESTABLISHED 1862

Complete Stock Carried at Niagara Falls
Also
G. S. GREEN CO.
74 Warren Street, New York City, N. Y.

COLUMBIA "3-C" Brand Calcium Chloride For CURING CONCRETE

A simple and more practical method of curing concrete road is provided by "3-C" Calcium Chloride.

The superiority of Calcium Chloride over other curing methods has been proved, convincingly, by hundreds of thorough and carefully conducted tests by many authorities.

Concrete road cured by "3-C" Calcium Chloride is stronger and may be opened to traffic after 7 days, instead of requiring 21 days as with old methods.

Here is a valuable saving of time and money —a vital factor in road building.

Send the coupon today for complete information.

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Manufactured by
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Please send complete information about the advantages of using "3-C" Calcium Chloride for Curing Concrete.

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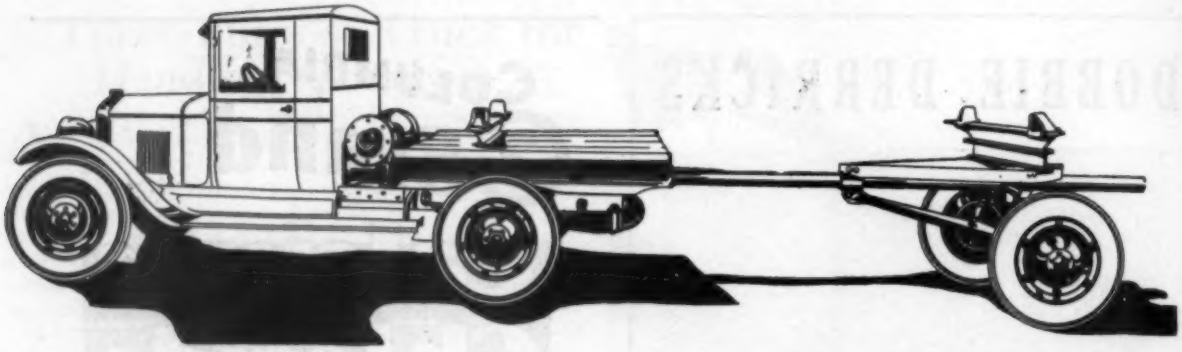


A Chevrolet Truck Equipped with a Champion Truck Winch and a Champion Floating Axle Trailer

will slip into an ordinary coat pocket. The dynamo principle insures its permanent capacity in contrast to the old magneto type which lost power with age. It is rated to fire ten electric blasting caps connected in series, but the manufacturers state that all tests have shown a 100 per cent power reserve.

The new machine is the development of three years work and experiment and is known as the Hercules Ten-Cap blasting machine. It is a convenient size for any kind of blasting where not more than 10 shots are fired at once.

A New ½-Yard Gasoline Crane-Shovel-Dragline

THE new 1020 Bucyrus-Erie ½-yard crane, which can easily be converted to a shovel, dragline or dragshovel, is the smallest of the complete line manufactured by the Bucyrus-Erie Co., South Milwaukee, Wis. It is equipped with a 48-horsepower gasoline engine, which gives it an extra margin of power for harder excavation and heavier crane work. Extra strength has been built into the machine to insure perfect performance in the harder digging and faster pace of which the machine is capable.

This crane has a one-piece steel truck frame and turntable. To insure easy mobility, the weight of the 1020 has been kept as low as is consistent with the necessary strength. Weight has been eliminated wherever possible without sacrificing reliability. All gears are enclosed and running in oil and antifriction bearings on all high speed shafts.

In design the 1020 is practically a smaller duplicate of the 1030, a ¾-yard gasoline shovel, crane and dragline, and it may also be furnished as an electric machine where electric power is available.

The 1020 Bucyrus-Erie ½-Yard Crane-Shovel-Dragline

Winches and Trailers for Use With Light Trucks

NEW truck equipment for contractors includes the Champion truck winches which feature light weight, with sufficient strength, ease of control, positive action, long constant service and safety to the operator, and the new Champion floating axle trailers which are manufactured by the Muskogee Iron Works, Automotive Division, Muskogee, Okla.

The Champion truck winches are particularly adapted for field, lumber or wrecking work, or for any job requiring lift or pull. These winches are furnished complete with power take-off, underdrive, cab controls, and mounting channels and angles with all necessary bolts and nuts for installing. The winch which is made in various models for use on Chevrolet, Ford and International trucks, is installed direct on the frame of the truck and is held in place by bolts or hot rivets. The inside of the truck frame is reinforced by a 5-inch channel and the outside by a mounting angle, which insures rigidity to the truck frame for winch mounting. The Champion winch for the Chevrolet has one speed forward and free release. The line speed can be varied by different motor speeds.

The Champion floating axle trailer is built of steel and is flexible and sturdy. The mounting of the cantilever springs causes the bolsters to stand nearly level, although the full load is resting on one side. The trailer is pulled from the rear axle through radius rods which extend to an adjustable pole, thereby relieving the spring of all tension load and only subjecting the springs to springing action. The floating axle consists of two axles enclosed in a housing of heavy tubing which serves as an oil reservoir, insuring proper lubrication and allowing minimum weight for equal strength.

The axles are held in position at the center by a bearing which takes the radial and thrust load. The outside ends of axles are supported by Hyatt roller bearings which are protected from the dirt by felt washers and retainers. The two axles prevent, to a great extent, the real shocks from being transmitted from one wheel to the other, thus giving more flexibility and less friction. These trailers have capacities of 1½ and 2 tons and weigh 775 to 850 pounds.

Track Units for Trailers

ANNOUNCEMENT has been made by the Smith Trailer Corp., Syracuse, N. Y., of the use on all its models of crawler type bottom dumping trailers, of Amsco track units, manufactured by the American Manganese Steel Co., 333 North Michigan Avenue, Chicago, Ill. In making these track units, a high percentage of manganese is used, to take care of the highly abrasive effect which many kinds of soil have on this type of unit. Great care was taken in designing these units to have as few working parts as possible, with the results that all truss action is eliminated.

Protect yourself!

with simple and direct

LIGHT

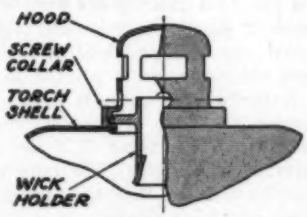
from a dependable source

in other words always use the

TOLEDO TORCH

PRETTY colored lanterns may get you by with cautious drivers, if you hire a watchman to keep them on the job. But it's the reckless ones who cause all the accidents. With them the use of uncertain signals, such as red lanterns, is a needless risk for you to take, especially when it is so much more costly than using TOLEDO TORCHES.

The New TOLEDO TORCH is dependable in all kinds of weather, is very economical in the use of fuel, and is never molested by petty thieves. The secret of its great success lies in the new ECONOMY BURNER. *(Patents Pending)*



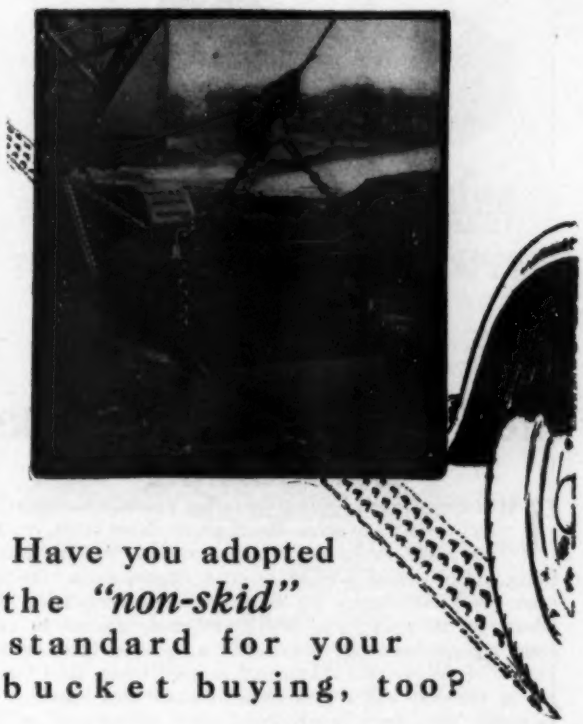
IT is the only burner that will give you satisfactory service at all times. Observe carefully its construction, and *insist on having the genuine.* Similar looking imitations do not compare in performance.

Ask for the *'Champion'*

"the harder it blows the better it burns"

Made only by

THE TOLEDO PRESSED STEEL CO.
TOLEDO, O.



Have you adopted the *"non-skid"* standard for your bucket buying, too?

ALL tires of today are skid-proof—and you can now get a dragline bucket that measures up to this same standard.

You don't see a WILLIAMS "Double-Arch" Dragline skidding over the top.

Exact design, with correct distribution of the weight, makes this bucket a real digger. One that fills itself in twice its own length, even on a shallow stripping cut. It gets its full loads faster—which means bigger output.

And you never see this bucket drawing in at the sides—

Because its rigid cast-alloy-steel bridge above, and heavy cast-steel digging lip below, provide a double arch that gives this bucket double rigidity.

Write for our Bulletin "DS-1" giving full description, and reports from contractors who know.

G. H. WILLIAMS COMPANY
609 Haybarger Lane, Erie, Pa.

Branch Offices
New York Pittsburgh Chicago

WILLIAMS
FAST-DIGGING BUCKETS

The complete WILLIAMS line of Clamshell and Dragline Buckets includes the exactly right bucket for your work.

A 10-foot Section of Blaw-Knox Universal Forms for Straight Concrete Curb

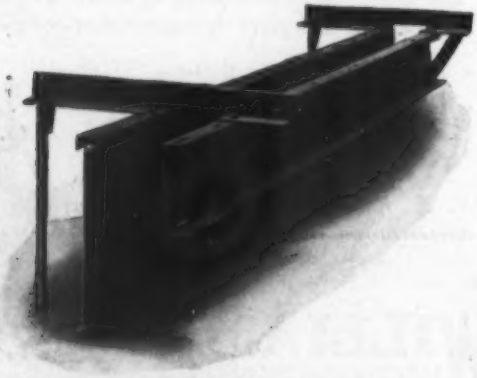
Steel Forms for Sidewalks and Curbing

THE use of wood for face forms has proved to be unsatisfactory in many ways. Wood warps, shows knots, cracks and board marks and requires excessive rubbing, refinishing and plastering in order to get a smooth finish. On the other hand, contractors are more and more considering the advantages of steel forms which are more efficient to use, easier and quicker to set and produce a smoother finish on the surface of the concrete. Compared to wood forms, steel forms are an economy and a convenience because they represent a permanent investment in equipment which can be used on job after job with only slight depreciation.

The Blaw-Knox steel face forms which are manufactured by the Blaw-Knox Co., 667 Farmers Bank Bldg., Pittsburgh, Pa., are made to fit the exact contour and shape of the work. They are perfectly smooth and will enable the user to obtain a neat job with minimum labor and finishing. These face forms require no clamps for installation. They are suspended from the back form by means of angle spacers and can be rapidly set up and dismantled. The angle spacers need not be detached from the face forms.

The Blaw-Knox Universal forms are made of the high quality blue annealed steel. Three 1-inch diameter round steel stakes of adequate length are furnished with every 10-foot section of form, except the 4-inch and 5-inch for forms which only require two stakes per section of form.

The forms are designed on the unit principle and can be built up to the required height and shape by the assembly of the proper units. Holes are provided in both the top and bottom flanges and quick acting bolt devices are used for the connections between units. All appurtenances for these forms are arranged so that there are no loose pieces to be mislaid or lost. There are only two parts to be handled, the form and the stakes.

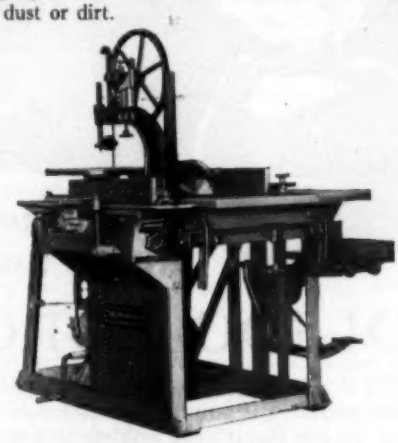


Set Up of Blaw-Knox Steel Forms for Integral Concrete Curb with a Batter Face

The lock joint furnished with the Blaw-Knox Universal forms is the same as the no-sag lock joint used on the Blaw-Knox Dreadnaught road form. It is easily and rapidly operated. A blow of the hammer is all that is required to drive home the lock joint plates and line up the forms at the joint. The staking system consists of a vertical stake pocket securely riveted to the web of the form. This system permits of the suspension of the form on the stage and locking it in position at any desired elevation, quite independent of the support of the subgrade. This is a great convenience as it eliminates blocking up the forms with wood, stones or earth.

Two New Saw Rigs

THE principal feature of the two new saw rigs recently announced by the C. H. & E. Mfg. Co., Inc., Milwaukee, Wis., is the use of a Texrope drive. This type of drive is silent, clean, simple, positive and economical, consisting of multiple V-sheaves and V-shaped Texrope endless belts. Power is transmitted by the wedging contact between the V-belts and V-grooves in the sheaves. Ample provision is made for taking up the stretch and this drive is not affected by moisture, dust or dirt.



The New C.H. & E. Home Builder's Saw Rig

The Home Builder's saw rig has three Texrope belts and the No. 18-A saw rig has five Texrope belts. The steel saw frame is electric welded. The table is steel plate and can be raised way back and held in position for filling the gasoline tank and putting water into the hopper of the engine.

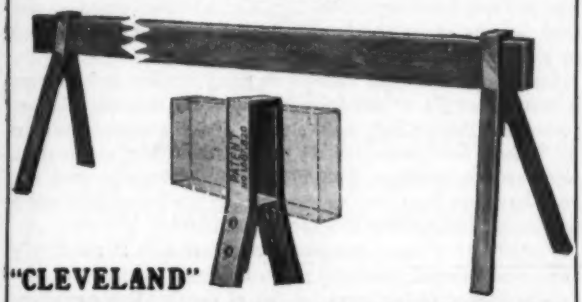
A boring attachment is mounted on the side of the saw frame. The table of this attachment has a horizontal travel of 6 inches by means of a foot pedal and is automatically returned by a spring. The table can be easily raised or lowered by turning a hand lever under the saw table. This attachment cuts fine mortises.

The jointer has a cylindrical safety head with four knives and has a strong cast iron frame. It will joint 6-inch wide stock, has wick-oiled bearings and both tables are adjustable. The gage is adjustable to 45 degrees. It will handle rabbetting, mitering, cornering, tapering, chamfering, and planing out of wind. This is right-handed operated jointer.

A 20-inch band saw is mounted with an individual clutch. The band saw table is 17 x 18 inches and can be tilted to 45 degrees. It has a horizontal capacity of 20 inches and a vertical capacity of 6½ inches.

The Home Builder's saw rig has a 12-inch saw with a capacity of 3-inch lumber and is equipped with a single cylinder 4-horsepower engine. The No. 18-A saw rig has a 14-inch saw with a capacity of 4-inch lumber and is equipped with a 2-cylinder 8-horsepower engine. All guards and gages are furnished and the machines are ready to operate upon delivery.

Eliminate the Hazard of Liability
USE



"CLEVELAND"
STEEL BARRICADE SUPPORTS

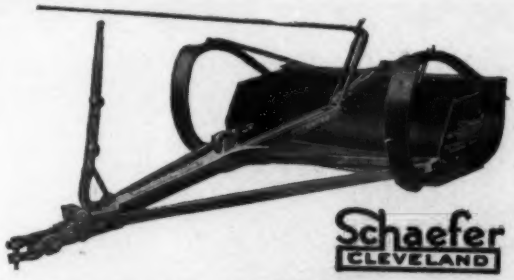
Painted red — Height 30 in. — For 2 x 6 stringer
Ruggedly constructed, self-locking, cannot wobble
Assembled and dismantled easily by one man
Heavy enough to withstand high-wind pressure
Placed anywhere on stringer, cleats eliminated
Initial cost is only cost—repairing eliminated

When your barricade supports need replacement or repairs get CLEVELAND STEEL BARRICADE SUPPORTS. They are PERMANENT EQUIPMENT and a REAL ASSET.

Used by cities of Philadelphia, Pittsburgh, Detroit, and Cleveland, Warren Bros., R. P. Conway Co., J. A. Mercier Co., and hundreds of others.

If your dealer cannot supply you write us direct

THE CLEVELAND STEEL SPECIALTY CORP.
6602 Park Ave. Cleveland, Ohio



Schaefer CLEVELAND

THE LEADING ONE-MAN SCRAPER

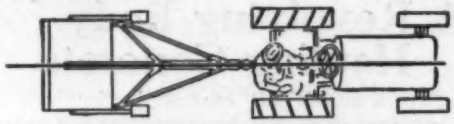
Leads in popularity, in ease of handling, in labor-saving, in economy

LOADS — DUMPS — SPREADS — LEVELS

Four stock sizes: 4, 5, 6 and 7 ft. wide.
The 4 foot and 5 foot (smaller type) models can be furnished with or without Auxiliary Back-Up Control.

Write for our Circulars

The Gustav Schaefer Company
Established 1850
4180 LORAIN AVE. CLEVELAND, OHIO



KEEPS TRACTOR AND SCRAPER IN LINE

The new Auxiliary Back-Up Control is handy for Short Hauls, for Excavating and for Back-Filling. It operates the scraper back-and-forth like a shuttle. It's not necessary to turn the tractor around.

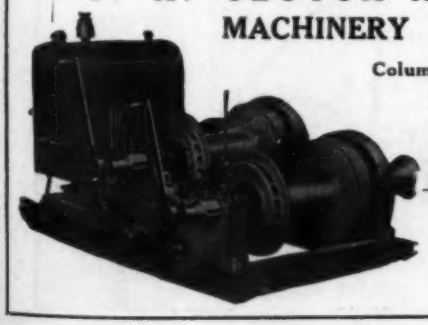
Have You the RIGHT Hoist for Your Job?

What load do you have to lift?
What line speed do you desire?
What kind of work is to be done?

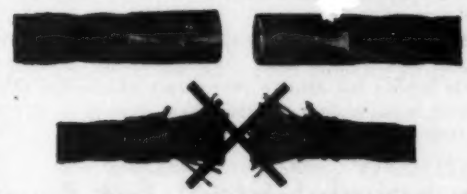
—Tell us, and we will specify the type and size of hoist best fitted to your job. There's an O. K. HOIST for every hoisting need—single-, double- or triple-drum, 8-150-horsepower, gasoline or electric power.

See our Catalog No. 28

O. K. CLUTCH AND MACHINERY CO.
Columbia, Pa.



The New Way To Cut Cable—



(1) One man whips and cuts any size up to 1" in less than a minute.

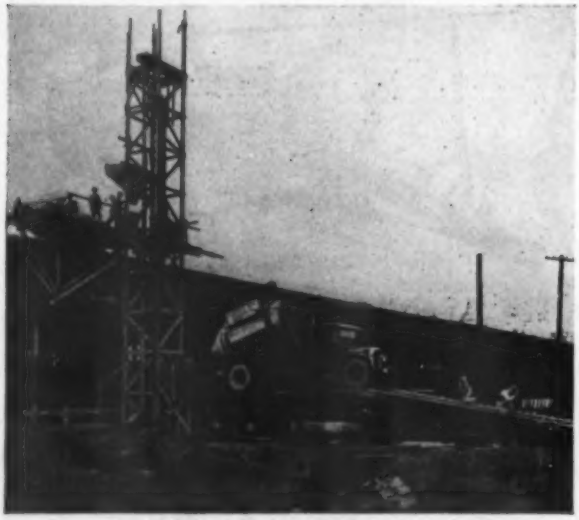
(2) Leaves cut ends incased in steel band—the ideal whip for passing through fixtures and fittings.

(3) Easily carried in kit (weight 8 lbs.)*

(4) No frayed ends—no cut hands—no delay.

* Larger cutter for 1½ in. cable: weight 20 lbs.

Starrett Steel Band and Cable Cutter
Write for Prices and Details
MORSE-STARRETT PRODUCTS CO.
1916 Broadway Oakland, California



A Transit Mixer Pouring a Portion of the Lovejoy Ramp on the Broadway Aqueduct, in Portland, Ore.

A Revolving Body for Hauling Concrete

A TRUCK-MOUNTED concrete hauling body of the revolving drum type for mixing concrete in transit is manufactured by the Transit Mixers, Inc., Call Bldg., San Francisco, Calif. This Paris Transit mixer meets the problem of ready-mixed concrete and eliminates the necessity of maintaining a central mixing plant since it mixes the concrete while on the road and delivers at the job a homogeneous mix.

The design of the revolving drum, the blade arrangement within the drum, the method of loading the aggregates into the drum while it is revolving, a tank of the dual compartment type for the main supply of water and the reserve, the transmission which allows the revolving of the drum in either direction and at all positions, and the controlled discharge all go to make a perfect and homogeneous mix, without separation of the aggregates.

This Transit mixer, the construction of which is sturdy, is of service not only to those desiring to offer a ready-mixed concrete service but also to contractors who would otherwise be forced to maintain a central mixing plant at some distance from their jobs.

A Special Steel for Construction Equipment

A STEEL which is meeting with general approval on construction equipment, and is known as Farrell's 85, has been developed by the Farrell-Cheek Steel Foundry Co., Sandusky, Ohio. This steel is manufactured under special processes and analyses, and the steel is being sold on its performance in the field. Many prominent construction machine builders are using it in preference to manganese steel and high priced alloys. This steel has been found to do away with such failures as breakage, distortion and rapid wear.

Farrell's 85 is used in cast parts in such equipment as power shovels, pavers, loaders, trucks, crawler wagons, scrapers, fresnoes, in machinery for pits, mines and quarries, steel mills and blast furnaces; in fact, in all fields for parts which are subject to severe wear and abrasion, shocks, overloading, impact and other service tending to rapid deterioration.

Evidence of the widespread popularity of this steel for securing lasting parts is shown in the fact that last year approximately 100,000 track shoes for crawler equipment alone were produced in it. More and more manufacturers are adopting this steel for shoe casting in addition to other parts, due to its good wear-resisting qualities, rigidity and toughness. Pin holes do not stretch and pitch centers are maintained true. Bushings are not necessary in the pin lugs of shoes made of this steel because of its ability to hold the shape of the lugs and to wear evenly.

One manufacturer of crawler wagons, scrapers and fresnoes is using Farrell's 85 exclusively. A loader manufacturer reported that using a high grade electric steel for several years for track shoes and rollers did not prove satisfactory, as the parts wore out too quickly. The adoption of manganese steel was considered and then they were advised to try Farrell's 85 which has proved satisfactory and its use continued.

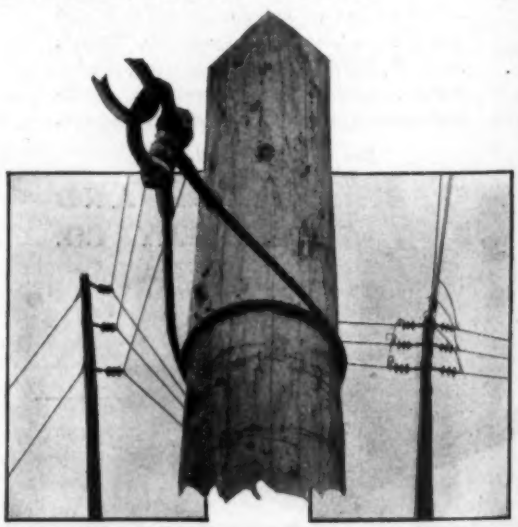
Farrell's 85 is not a manganese steel and sells at about only two cents a pound above the prices obtained on the same castings in regular carbon steel. A list of construction equipment manufacturers who use this steel exclusively in their equipment includes several of the leading manufacturers of clamshell and orange peel buckets, the leading power shovel manufacturers, well-known winch and hoist manufacturers, concrete mixer manufacturers and wagon loader manufacturers.

A New Development in Dead End Slings

FOR some time there has been dissatisfaction with the methods of dead-ending or turning the direction of a transmission line. The method has been to cut or bore into the wood pole, which in cases of creosoted wood, exposes the wood to the elements with decay and weakened structure as a result. However, through the development of a new type of dead-end sling, by the American Cable Co., 315 North Michigan Avenue, Chicago, Ill., all necessity for mutilating corner or dead-end poles has been eliminated.

The use of wire rope for dead-end slings was cumbersome and impractical until the development of the preformed type of wire rope, which permits the attachment of the compact, positive, processed fitting. These fittings, shown in the illustration, which are attached to the wire rope and fit into the shackle and cotter-pin bolt, are merely steel cylinders which have been slipped over the unseized end of the preformed rope, by means of 100 tons hydraulic pressure, so processed as to cold flow the steel into the interstices of the wire rope, thereby locking it to the rope securely.

This new type of dead-end sling is being adopted by public utilities, railroads, builders and contractors.



The American Cable Co.'s Dead End Sling

THE SANDERSON CYCLONE DRILL CO., ORRVILLE, OHIO

DRILLS

and drill tools for every kind of Big Blast Hole Drilling

Catalog Mailed on Request

Boosting Excavating Profits

Contractors are turning, more and more, to Sauerman Slackline Cableways for the handling of both little and big excavating jobs where the materials have to be dug, elevated and conveyed from the pit.

The money they are saving by the low first costs, low operating costs, etc., is represented by the increase in net profits. Write for the *Excavating for Profit* booklet and see how you can do the same.

SAUERMAN BROS., INC.

464 So. Clinton St. Chicago

ALL STEEL HAND HOIST — SEATTLE, U.S.A.

"The Strongest Geared Power for Its Weight in the World"

Capacity 5 Tons Straight Line

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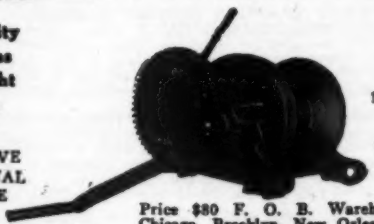
POSITIVE INTERNAL BRAKE



Weight 110-lbs.

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Size 16x17x13-in. high

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Two Speeds 4 to 1 24 to 1

Price $80 F. O. B. Warehouse Points, Chicago, Brooklyn, New Orleans, Houston.

Dealers in Principal Cities

Write for descriptive circular with users' endorsements and name of nearest dealer.

BEEBE BROS.

3219 First Ave., So. Seattle, Wash.

HOISTING BLOCKS

* STAR BRAND *

Are Always Reliable

Made for

Every Condition of Service

Sold by

Leading Supply Houses

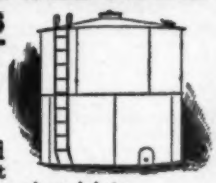
Let us help you with your problems

BOSTON & LOCKPORT BLOCK CO.

NEW YORK BOSTON CHICAGO

BOLTED TANKS

& WELDED TANKS



For Oil, Water, Brine, and Various Liquid & Dry Commodities.

Shipped K. D. in sections and bolted together with special gasket and cement, making tight and impervious joints.

In case of removal, easily disassembled and re-erected. Capacities to a million gallons and larger. Write for our folder, "Bolted Tanks In Industry."

COLUMBIAN STEEL TANK CO.

KANSAS CITY, MO. ESTABLISHED 1893

The UNION No. 9 MIDGET HAMMER

Designed to come within the weight range of the pavement breaker and the rock drill type of hammer, and at the same time do more work with less air consumption.

Weighs 97 pounds, delivers over 250 blows per minute and strikes a 275-pound blow.

Send for copy of new catalog No. 124 on "Pile Driving Machinery and Foundation Equipment"

UNION IRON WORKS

Builders of Double Acting Pile Hammers since 1906

West Shore Siding Hoboken, N. J.

"TEN TIMES MORE LIGHT"

"Ten times more light than an oil lantern, and at less cost"—

This remark by a railroad man explains why thousands of National Carbide Lanterns are being used today by contractors, miners, tunnel workmen, street repair crews, and others who want a dependable, strong, clear and penetrating light.

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LANSING 10-S MIXERS

Powered with a 4-cylinder, 12-hp. gasoline engine. *8 seconds to elevate skip from ground and 15 seconds to empty.* Automatic clutch knockout-bar holds skip in charging position. Operating levers arranged on drum end, making effective one-man control.

Thirteen heavy-duty Hyatts mean long-life and easy running. Rubber-tired wheels. Capacity: Mixed concrete per batch, 10 cubic foot Drum heads shaped to throw material towards center, away from openings. Alemite Pressure lubrication gives quick thorough greasing. GET THE COMPLETE SPECIFICATIONS ON THIS FAMOUS MIXER. *Have YOU the latest Lansing Catalog?*

Mixers — Scrapers

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CONTRACTORS USE THIS SERVICE

These especially selected catalogs and pamphlets of value to contractors are for free distribution. You will find it worth while to check these lists each month and write for the catalogs you need.

A TWO-PURPOSE PUMP
A new self-priming pump for seepage or volume, with a capacity of from one gallon to 6,000 gallons per hour and a weight of only 75 pounds, is described in literature of the Homelite Corp. (W. S. Mauger, Sales Mgr.), 71 Riverdale Ave., Portchester, N. Y.

STEEL FORMS FOR SIDEWALKS AND CURBING
Bulletin No. 1024 contains a complete description of the Blaw-Knox steel street forms for curbs, curbs and gutters, integral curbs and sidewalks and may be secured from Blaw-Knox Co. (D. Clinton Grove, Adv. Mgr.), 667 Farmers Bank Bldg., Pittsburgh, Pa.

GOOSE-NECK HEAVY DUTY TRAILERS
Five styles of heavy duty trailers, including a monster with eight rocking wheels and sixteen tires at the rear, all of which are designed for rugged and lengthy service, are described in a new catalog which may be secured from the Rogers Brothers Corp. (Charles A. Rogers, Pres.), 108 Orchard Street, Albion, Pa.

DRILLS AND DRILL TOOLS
A catalog describing the complete line of drills and drill tools for every kind of big blast hole drilling may be secured from the Sanderson Cyclone Drill Co. (I. L. Albaugh, Sales Mgr.), Orrville, Ohio.

AN ADJUSTABLE STRIP TIE AND SPACER
Adjustable strip ties and spacers, made in three standard sizes and designed to give an efficient tie for clamping concrete forms together and spacing them, are described in a pamphlet "The Tie that Binds and Spaces" which may be secured from the M & M Wire Clamp Co. (Howard O. McMillan, Pres.), 2 Fifth Street, S. E., Minneapolis, Minn.

CENTRIFUGAL PUMPS OF LARGE VOLUME
Bulletin 181 contains a complete description of the Rex centrifugal pumps, made in a wide range of sizes and powered by a LeRoi engine, and may be secured from the Chain Belt Co. (R. A. Shilbauer, Asst. Adv. Mgr.), 766 Park Street, Milwaukee, Wis.

COMPLETE LINE OF MIXERS AND PAVERS
Catalogs describing the complete line of Boss mixers and pavers, made in a variety of sizes and types to suit the needs of every contractor, may be secured from the American Cement Machine Co. (O. G. Mandt, Pres.), 234 So. Fourth Street, Keokuk, Iowa.

A STURDY FOUR-WHEEL-DRIVE TRACTOR
The Atlas 4-wheel-steer 4-wheel-drive tractor which will plow its way through mud, snow or sand under the most adverse conditions and which is sturdy and reliable in construction is described in literature of the Atlas Engineering Co. (C. W. Zimmerman, Vice-Pres.), Box N, Clintonville, Wis.

RUTLESS, SKID-SAFE ROADS
The construction of rutless, smooth, storm-proof, skid-safe roads by the use of Tarvia, a bituminous material for surfacing roads, is described in literature which may be secured from the Barrett Co., 40 Rector Street, New York.

A FULL-REVOLVING CONVERTIBLE POWER SHOVEL
Catalog R-2 contains a complete description of the Bay City Model R ¾-yard, 26-ton full revolving convertible power shovel and may be secured from Bay City Shovels, Inc. (W. S. Ramsay, Pres.), Bay City, Mich.

CALCIUM CHLORIDE FOR CONCRETE CURING
Complete information on the Columbia 3-C brand of calcium chloride for use in concrete construction which will save time in curing the concrete and give better results, will be sent on request to any one interested by the Pittsburgh Plate Glass Co., Columbia Chemical Div., Barberton, Ohio.

A NEW IDEA IN CONCRETE AND MATERIAL TOWERS
The Lakewood Engineering Co. (Lion Gardiner, Vice Pres.), Cleveland, Ohio, has recently brought out a pipe material tower with a concrete bucket which travels on the outside of the tower on a set of separate guides and is entirely independent of the material cage. Complete information may be secured from the company.

NEW SUPPORT FOR ROAD REINFORCEMENT
A new support for wire mesh concrete road reinforcement which makes it possible to place the mesh before any concrete is poured and which is made to conform to all state highway specifications, is being made by the Highway Steel Products Co., 14th & McKinley Sts., Chicago Heights, Ill., from whom complete data may be secured on request.

A THREE-PURPOSE TRUCK FOR HANDLING CONCRETE
Bulletin TM-2 contains a complete description of the Agitate-in-Transit truck mixer body, a three-purpose body for mixing concrete in transit, hauling ready-mixed concrete or sand and gravel, and may be secured from the Truck Mixer Co., Columbus, Ohio.

A NEW ½-YARD GASOLINE CRANE-SHOVEL-DRAGLINE
Bucyrus-Erie Co. (F. O. Wyse, Asst. Adv. Mgr.), South Milwaukee, Wis., will send to any one interested a complete description of the new Bucyrus-Erie 1020 ½-yard crane-shovel-dragline, which is designed for extra hard digging and heavier crane work.

A TRUCK-MOUNTED CONCRETE MIXER
A truck-mounted concrete mixer of the revolving drum type for mixing concrete in transit is described in literature which may be secured from Transit Mixers, Inc. (E. F. Hill, Jr., Sales Mgr.), Call Bldg., San Francisco, Calif.

TWO NEW SAW RIGS
The C. H. & E. Mfg. Co., Inc., 254 Mineral St., Milwaukee, Wis., will be pleased to send complete information and prices on its two new saw rigs, the Home Builder's saw rig with three Texrope belts and the No. 18-A saw rig with five Texrope belts, in both of which ample provision is made for taking up the stretch and the drive is not affected by moisture, dust or dirt.

A LIGHT WEIGHT TRACTION DIGGING MACHINE
The Industrial Brownhoist Corp. (G. F. Climo, Sales Mgr.), Cleveland, Ohio, will be glad to send to those interested its bulletin describing the Topping pony-ditcher, a light weight, crawler-mounted trench digger that is reasonably priced and has a capacity ranging from 13 to 30 inches in width with a maximum depth of 7½ feet.

A CONVERTIBLE SHOVEL FOR ALL TYPES OF SERVICE
A rugged, sturdy and reliable piece of construction equipment which is known as the Conqueror and may be used as a shovel, backhoe, dragline, clamshell, crane, pile driver or magnet is described in Bulletin 2806 which may be secured by writing to the Osgood Co. (C. A. Owens, Secy.), Marion, Ohio.

TRACK UNITS FOR TRAILERS
The Amsco track units which are made of a high-grade manganese steel in 5, 7, 10, 15, 20 and 25-ton capacities, and which are used on the Smith crawler type bottom dumping trailers are described in literature, which may be secured from the Smith Trailer Corp. (R. S. Goldthwait, Vice-Pres.), Syracuse, N. Y.

A CONVERTIBLE ½-YARD SHOVEL
Byers Machine Co. (C. G. Kingsbury, Sales Mgr.), Ravenna, Ohio, will send to any one interested its 32-page catalog describing the ½-yard Byers Bulldog which is a unit designed to operate with the shovel, crane, skimmer, or ditcher attachments by merely changing the boom and performs equally well with a clamshell, dragline, hookblock, pile driver or magnet on a 35-foot crane boom.

TRACTOR IN NEW SIZE MAKES LINE COMPLETE
A complete description of the new tractor, known as the Caterpillar Fifteen, which completes the line of small Caterpillar track-type tractors, may be secured from the Caterpillar Tractor Co. (W. H. Gardner, Adv. Mgr.), San Leandro, Calif.

SPHERICAL AND HEMISPHERICAL ROADSIDE TORCHES
R. E. Dietz Co., 60 Laight Street, New York, will be glad to send to those interested complete information in regard to its spherical and hemispherical roadside torches, which are solidly built of steel, burn kerosene, light fuel oil or crude distillate, burn steadily from 20 to 24 hours and are provided with a cast steel burner, heavy carrying loop and an automatic lock which prevents the wick from dropping down inside.

NEW HORIZONTAL TYPE ENCLOSED GAS ENGINES
The Stover Mfg. & Engine Co. (Lee Madden, Vice-Pres.), 25 Lake St., Freeport, Ill., has developed a new horizontal type completely enclosed gas engine which lubricates with the splash system, eliminating the many oil holes or cups and protecting the engine from dust, sand, sawdust and other foreign materials.

A PORTABLE TWO-PIECE PLANT FOR MEASURING AGGREGATES
The Erie Steel Construction Co. (R. E. Daub, Adv. Mgr.), Erie, Pa., will be glad to send to those interested a complete description of its new Type-G portable AggreMeter plant, easily erected in the field and ranging in capacity from 60 to 91 tons.

AN IMPROVED MIXER WITH MANY FEATURES
The improved Marsh-Capron Master-7 mixer which has among its features Timken tapered roller bearings, interchangeable rubber tired and steel wheels, Diamond roller chain drive fully enclosed and running in oil, Marsh-Capron rail track and 14-gallon Wonderquick water tank, is described in Bulletin 2901 of the Construction Machinery Co. (G. A. Loveall, Adv. Mgr.), 447 Vinton Street, Waterloo, Iowa.

WINCHES AND TRAILERS FOR USE WITH LIGHT TRUCKS
The Champion truck winches in a number of models for use with Chevrolet, Ford and International trucks and the Champion floating axle trailers are described in a folder which may be secured from the Muskogee Iron Works, Automotive Division, Muskogee, Okla.

A NEW AND FASTER PAVER
The new 1929 MultiFoote paver which has a number of improvements and new features which go to increase its performance is described in Folder No. 93 which may be secured from the Foote Co., Inc. (Fred L. Dake, Secy. and Treas.), Nunda, N. Y.

PAVING CULVERTS TO COMBAT EROSION
A 16-page illustrated booklet "Paving the Culvert to Combat Erosion" has been issued by the Armco Culvert Manufacturers Association (Anton S. Rosing, Pub. Mgr.), Middletown, Ohio, describing the effects of erosion on culverts and the advantages of the Armco paved invert culvert.

ELECTRIC WHEEL COMPANY

Designers and makers of complete mounting equipment for America's leading manufacturers of portable machinery. Wheels, trucks, trailers, crawlers, and parts built for individual requirements.

Catalogs on request

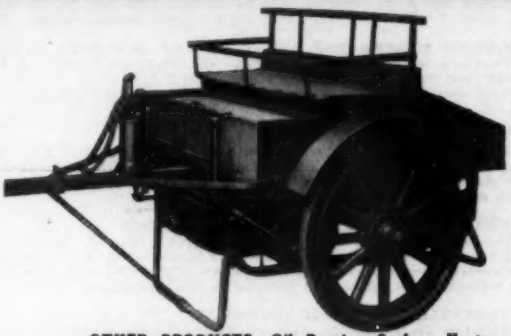
Department CM., QUINCY, ILL.

SAVE MONEY in Heating Asphalt Tamping Tools

This Chausse Oil Burning Tool Heater will save its own cost in a few weeks. It is one of the greatest labor-saving machines made for asphalt street work. It starts in 5 minutes, heats cold tools in 15 minutes, does not burn tools, has no sparks, smoke nor ashes. It is unaffected by wind or rain. Has space for warming 6 buckets of A. C. without overheating. Is widely used by cities and contractors and is considered the most modern asphalt fire wagon.

Chausse Oil Burner Company

Elkhart, Indiana



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More miles of good roads for less money where

BURCH SPREADERS

are used for building high-grade macadam roads.

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THE BURCH CORPORATION Crestline, Ohio

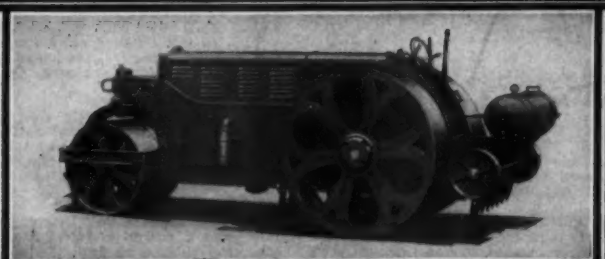
HUBER

4 CYLINDER MOTOR ROLLERS

POWERFUL AND DEPENDABLE

QUICK IN ACTION

ECONOMICAL TO OPERATE



MADE IN FOUR SIZES

5—7—10—12 TONS

SEND FOR HUBER ROLLER CATALOG

330 E. CENTER ST. **THE HUBER MANUFACTURING CO.** MARION, OHIO

A REVOLVING TRACTOR SCRAPER

The Groundhog revolving tractor scraper which is easily operated by a long lever which regulates the depth of the cut and a simple control for loading, dumping and spreading which works instantly is described in literature of the Roderick-Lean Co. (Frank H. Smith, Sales Mgr.), Dept. 9, Mansfield, Ohio.

A NEW TYPE OF BLASTING MACHINE

A new pocket size blasting machine known as the Hercules Ten Cap machine has been announced by the Hercules Powder Co. (N. S. Greensfelder, Adv. Mgr.), Wilmington, Del. This machine is rated to fire ten electric blasting caps connected in series and weighs only 4½ pounds and applies the dynamo principle of blasting.

A MACHINE FOR TESTING CONCRETE ROAD SURFACES

The Tinius Olsen Testing Co. (T. Y. Olsen, Treas.), 500 N. 12th St., Philadelphia, Pa., will be glad to send to those interested complete information in regard to its road surface rater for detecting and indicating unevenness in newly constructed concrete road surfaces.

THE TWO-MAIN SYSTEM OF UNDERGROUND PIPING

This is the title of a new booklet issued by the Cast Iron Pipe Research Association (Thos. F. Wolfe, Research Engr.), 122 South Michigan Ave., Chicago, Ill., describing the two-main system of piping for water which guarantees that for all time traffic will never be interrupted through pipe replacements or additions to either mains or services.

CLAMSHELL BUCKETS OF SPECIAL DESIGN

Complete information in regard to the Kiesler clamshell buckets, designed on a special double-lever arm principle, with rugged construction and great capacity, may be secured from the Jos. F. Kiesler Co. (Jos. F. Kiesler, Pres.), 936 West Huron Street, Chicago, Ill.

HOISTING BLOCKS FOR ALL KINDS OF SERVICE

Complete information in regard to the Star brand hoisting blocks which are reliable and sturdy and made for every condition of service may be obtained from the Boston & Lockport Block Co. (H. P. Abbott, Vice-Pres.), East Boston, Mass.

ASPHALT MIXING PLANTS

Bulletin 2D of the Barber Asphalt Co. (W. F. Hartzell, Adv. Mgr.), 1600 Arch St., Philadelphia, Pa., describes in detail Iroquois asphalt mixing plants which are adapted to the production of bituminous mixtures with minimum operating costs and maximum output.

A GRADER WITH NEW LIFTING MECHANISM

The W. A. Riddell Co., (W. A. Riddell, Pres.), Dept. F., Bucyrus, Ohio, will be glad to send to those interested a complete description of its new rear-control, one-man Warco grader, which is equipped with a new screw lift mechanism for raising and lowering the blade easily.

A PORTABLE AUTOMATIC CONVEYOR

Bulletins describing the Chicago automatic belt and bucket portable conveyors for use in many kinds of construction work may be secured from the Chicago Automatic Conveyor Co. (H. H. Dreyer, Adv. Mgr.), 1853 South 55th Avenue, Cicero, Ill.

PUNCHES, DIES AND RIVET SETS

The Cleveland Steel Tool Co. (R. J. Venning, Treas.), 660 East 82nd Street, Cleveland, Ohio, will be glad to send to those interested its catalog No. 9, containing complete descriptions of Cleveland punches, dies and rivet sets, as well as a line of special tools.

A COMPLETE LINE OF CRAWLER TRACTORS

A new 32-page booklet with more than 100 illustrations contains complete information in regard to the Cletrac 20, 30, 40 and 100 tractors for every power need and may be secured from the Cleveland Tractor Co. (H. E. Orr, Adv. Mgr.), 19321 Euclid Avenue, Cleveland, Ohio.

HOISTS AND DERRICKS

Sturdy and reliable hoists and derricks for all types of services in construction work are described in literature which may be secured from the Clyde Iron Works Sales Co. (R. A. Dunning, Asst. Sales Mgr.), Duluth, Minn.

CONCRETE GRINDER FOR SMOOTH SURFACES

A complete description of the Berg concrete grinder, equipped with a cutter, carborundum and steel brush heads, in either electric or air drive models for removing fins, board and form marks and all surface irregularities from concrete may be secured from the Concrete Surfacing Machine Co., Dept. F., (M. Wetstein, Pres.), 4667-69 Spring Grove Avenue, Cincinnati, Ohio.

INDUSTRIAL JACKS

Simplex Jacks for industrial, engineering and construction work which are distinctive in man power, safety and simplicity are described in literature which Templeton, Kenly & Co. (H. B. Burlow, Mgr., Jobbing Sales), 1020 So. Central Avenue, Chicago, Ill., will be glad to send to those interested.

CENTRIFUGALLY CAST IRON PIPE

The de Lavaud pipe which is centrifugally cast from molten metal to increase its tensile strength is described in a handbook which may be secured from the United States Cast Iron Pipe & Foundry Co. (John D. Capron, Publicity Mgr.), Burlington, N. J.

A WATER CHLORINATOR

Wallace & Tiernan Co., Inc. (W. J. Orchard, Gen. Sales Mgr.), Newark, N. J., will send to any one interested complete details in regard to the W & T water chlorinator which insures safe drinking water on any job.

STEEL SHEET PILING

Complete data and prices of the steel sheet piling which may be bought, sold or rented may be secured from Wemlinger, Inc. (J. R. Wemlinger, Pres.), 149 Broadway, New York.

COMPRESSORS WITH SEVERAL FEATURES

Compressors which are particularly adapted for cold weather use because of the ease with which the engine can be started independently of the compressor, and which has a balanced crankshaft and a forced feed oiling system and is made in two sizes, 120 and 240 feet of free air piston displacement, are described in a catalog which the O. K. Clutch & Machinery Co. (H. Druschel, Mgr.), Columbia, Pa., will send to those interested.

A HOIST FOR EVERY NEED

A copy of the general hoist catalog K and a valuable hoist manual describing the complete line of Brown Giant-Line single and multiple drum, reversible, non-reversible and conveyor type hoists will be sent on request to any one interested by the Brown Clutch Co. (Oliver F. Rinderle, Pres.), Sandusky, Ohio.

TRACTION BELT DRESSING

Circular 148-O describes in detail Dixon belt dressing for use on leather, rubber and fabric belts in order to increase the life of the belt as well as to improve its performance and may be secured from the Joseph Dixon Crucible Co. (B. L. Rowley, Adv. Mgr.), Jersey City, N. J.

ONE TO THREE-TON TRUCKS

Complete information in regard to Dodge trucks, ranging from one to three tons with wheelbases from 130 inches to 185 inches, may be secured from Dodge Brothers Corp. (Frank Sim, Adv. Mgr.), Detroit, Mich.

MAGNETOS FOR CONSTRUCTION EQUIPMENT

The Eisemann Magneto Co. (E. S. Clark, Adv. Mgr.), 165 Broadway, New York, will be glad to send to those interested a complete description of the Eisemann magneto for construction equipment.

AN ALL-STEEL SPRING-MOUNTED MIXER

The complete line of Jaeger all-steel, spring-mounted, tilting and non-tilting mixers is described in catalogs which the Jaeger Machine Co. (O. G. Mandt, Vice-Pres.), 701 Dublin Avenue, Columbus, Ohio, will be glad to send to those interested.

BOILERS FOR CONTRACTORS EQUIPMENT

Johnston Brothers, Inc. (J. F. Johnston, Pres.), Ferrysburg, Mich., will be glad to send to those interested complete information in regard to the Johnston steel boilers for contractors equipment.

CONCRETE MIXERS

Literature describing the 1929 models of the Lauson concrete mixers of various types may be secured from the John Lauson Mfg. Co. (R. G. Lauson, Mgr.), 11 Jackson Street, New Holstein, Wis.

SELF-LOADING FOUR-WHEEL SCRAPERS

Catalogs describing Baker-Maney self-loading four-wheel scrapers which come in three models, 1½-yard, 1-yard and ¾-yard, and which simplify grading and earth moving, may be secured from the Baker Mfg. Co. (L. A. Ginzel, Secy.), 585 Stanford Avenue, Springfield, Ill.

HIGH QUALITY HOISTS

Bulletin A contains a complete description of Sterling hoists, which are equipped with Timken roller thrust bearings, asbestos frictions, Alemite-Zerk lubrication, ground precision shafting and an improved screw thrust, and may be secured from the Sterling Machinery Co. (R. G. Barsen, Secy.), 2303-7 Holmes Street, Kansas City, Mo.

POWER FOR EVERY PURPOSE

The full line of Continental engines which give speedy and reliable service in operating various types of crushers and other construction equipment is described in literature which may be secured from the Continental Motors Corp. (L. J. Kanitz, Mgr., Industrial Div.), Muskegon, Mich.

LUBRICANTS FOR TRUCKS, TRACTORS, AND SHOVELS

A complete description of D-A lubricants for tractors, trucks, cranes, shovels and other heavy construction equipment, the use of which speeds up operations and increases the length of service of the equipment, will be sent to those interested by the D-A Lubricant Co. (P. C. La Blant, Sales Mgr.), Indianapolis, Ind.

AIR COMPRESSORS IN MANY TYPES AND SIZES

The complete line of Buhl air compressors, made in a variety of sizes and types to meet every portable compressor demand, is described in a bulletin of the Buhl Co. (W. I. Buhl, Gen. Mgr.), Old Colony Bldg., Chicago, Ill.

A COMPLETE LINE OF DEPENDABLE TRUCKS

The line of White motor trucks which are dependable and rugged, designed for lengthy construction service, and which come in a number of sizes to meet the various requirements of users, are described in literature of the White Co. (Stanley P. Seward, Adv. Mgr.), Cleveland, Ohio.

HOISTS AND DUMP BODIES

The Wood Hydraulic Hoist & Body Co. (Frank H. Dewey, Gen. Mgr.), Detroit, Mich., will send complete information on request to those interested in regard to the Wood hoists and all steel dump bodies which are sturdy in construction, have a high dumping angle, speed in raising, and are powerful and economical to run.

CAST IRON PIPE

Cast iron pipe with smooth, tight, flexible yet dependable joints and easily laid in any kind of weather is described in literature which may be secured from the Central Foundry Co. (Henry Hoeltge, Adv. Mgr.), Graybar Bldg., 420 Lexington Avenue, New York.

SAND AND GRAVEL EQUIPMENT

This is the title of an 80-page booklet which describes in detail the complete line of sand and gravel equipment manufactured by the Good Roads Machinery Co. (J. Warren Kitts, Adv. Mgr.), Kennett Square, Pa.

EXPANSION JOINTS FOR CONCRETE ROADS

Expansion joints made of carefully selected fibrous asphalt, permanently pressured between two layers of asphalt-saturated felt, are described in literature which may be secured from the Philip Carey Co. (Charles D. Easton, Adv. Mgr.), Lockland, Cincinnati, Ohio.

PAVEMENTS THAT LAST

Warren Brothers Co., Boston, Mass., will be glad to send to those interested a complete description of the Warren-bitulithic pavements, the pavements which last.

STUMP PULLERS FOR USE WITH TRACTORS

The Dorsey Model B Stump pullers, for use with Caterpillar tractors, which are safe, sturdy and dependable, are described fully in a booklet which may be secured from Dorsey Brothers, Elba, Ala.